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A Revision of the American Genus *Anisota* (Saturniidae)

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Introduction

Michener (1952) revised the Saturniidae of the Western Hemisphere at the generic level, but except for occasional mention of species, these were not treated. Recent discovery of new species of the genus *Anisota* Huebner in Ontario, Texas, South Carolina, and Mexico made it desirable to do research into the morphology of all related species, and as no details have been published about the adults and immature stages of all the North and Central American species of *Anisota* since Packard (1905) and Bouvier (1931), it seemed advisable to summarize our knowledge in this paper.

Higher Classification

The genus *Anisota* belongs to the moth family Saturniidae belonging to the superfamily Bombycoidea which also includes Lasiocampidae and Bombycidae (Ferguson, 1971).

The correct subfamily name has been, and continues to be, disputed. Lemaire (1976) indicated that Adelocephalinae, Boisduval 1868, is the correct name. Earlier authors used other names such as Dryocampinae, Ceratocampinae, and Syssphinginae. The name Citheroniinae has had wide usage, even in recent works (Michener, 1952; Ferguson, 1971). The subfamily has frequently been elevated to family rank under the various names throughout much of the literature (i.e., Citheroniidae, Syssphingidae). Whether considered a family or subfamily, the group is clearly a monophyletic assemblage. It is one of the more primitive subfamilies of Saturniidae and is exclusively New World in distribution. Most genera and species are neotropical; *Anisota* is in fact, the only predominantly nearctic genus of the subfamily, excepting the allied *Dryocampa* Harris. Michener (1952) and Ferguson (1971) characterized the subfamily morphologically—it is our purpose from here on to deal only with the genus *Anisota*.

As the lists of synonyms indicate, species of *Anisota* have often appeared in the literature under several generic names (*Adelocephala, Dryocampa*, etc.). Fortunately however, the name *Anisota* has rarely been applied to species which are not true *Anisota*, an exception being the Brazilian *Psigida apollinairei* (Dognin) which Grote (1867) redescribed as *Anisota walkeri*.

Michener (1952) subdivided the genus *Anisota* into two subgenera: *Dryocampa* and *Anisota*, the characters of which may be found in Table 9 of his paper. Ferguson (1971), however, pointed out correctly that the one species belonging to *Dryocampa* "seems quite far removed from all the species of *Anisota.*" He therefore elevated *Dryocampa* to generic rank in which the present authors follow him, especially because of the characters shown in the immature stages, the male genitalia and other morphological characters. In the present paper therefore we only treat the species of Michener's subgenus *Anisota. Dryocampa* represents a separate migration into North America from the neotropical fauna. The genus is perhaps closest to *Anisota* (*sensu stricto*), an idea supported by the work of Pease (1961). We propose that *Dryocampa* and *Anisota* are sister-groups, diverged in Central America, and radiated into North America where their respective hostplants (*Acer* and *Quercus*) are more available.

Methods

Genitalic dissections were made of a certain number of male and female specimens of each species from different populations where applicable. Also the heads of male and female specimens were detached from the body, cleaned, measured as to eye-size and head-proportions as well as the form of the rear joint of the head. Also anterior legs were removed and cleaned for examination of the epiphysis. Labial palpi were also removed and cleaned and studied.

Special emphasis was placed on the immature stages. In the larvae, the suranal plate was studied and figured, which is distinct for each of thespecies. The pupae were photographed in a position to show their specifically different cremaster. In two species, scanning electron micrographs (Plate V) were made of the cuticle of larvae (see Byers & Hinks, 1973).

Localities and flight periods for specimens examined are cited under each species account. Full specimen data have been deposited in the library of the Royal Ontario Museum and are accessible for reference. Most of the material collected or received by the authors during the course of this study has been deposited into major museums (notably ROM, AMNH and LACM). The abbreviations used in the text for collections from which material for this study was examined are as follows:

AMNH	American Museum of Natural History, New York, New York
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii
BMNH	British Museum (Natural History), London, England
CalAcSci	California Academy of Sciences, San Francisco, California
CLU	Clemson University, Clemson, South Carolina
CM	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania
CNC	Canadian National Collection of Insects, Ottawa, Ontario
FIS	Forest Insect Survey, Canada
FMNH	Field Museum of Natural History, Chicago, Illinois
FSCA	Florida State Collection of Arthropods, Gainesville, Florida
Heitzman Coll.	Collection of J. Richard Heitzman, Independence, Missouri
IBM	Instituto de Biologia, Mexico City, Mexico
Kendall Coll.	Collection of Roy & C. A. Kendall, San Antonio, Texas
LACM	Los Angeles County Museum of Natural History, Los Angeles, California
Lemaire Coll.	Collection of Claude Lemaire, France (now in MNHN)
LSU	Louisiana State University, Baton Rouge, Louisiana
LM	Lyman Entomological Museum, Ste-Anne-de-Bellevue, Quebec
McM	McMaster University, Hamilton, Ontario

MHNM	Museo de Historia Natural, Mexico City, Mexico Cambridge, Massachusetts
MNHN	Museum National d'Histoire Naturelle, Paris, France
MSU	Michigan State University, Lansing, Michigan
Peigler Coll.	Collection of R. S. Peigler, Greenville, South Carolina
RIB	Entomology Research Institute, Belleville, Ontario (now closed)
ROM	Royal Ontario Museum, Toronto, Ontario
Sieker Coll.	Collection of William E. Sieker, Madison, Wisconsin
TAMU	Texas A&M University, College Station, Texas
UArk	University of Arkansas, Fayetteville, Arkansas
UCal	University of California, Berkeley, California
UFl	University of Florida, Gainesville, Florida
UG	University of Guelph, Ontario
UGa	University of Georgia, Athens, Georgia
UIl	University of Illinois/Illinois Natural History Survey
UM	University of Michigan, Ann Arbor, Michigan
UMo	University of Missouri, Columbia, Missouri
USNM	United States National Museum of Natural History, Washington, D.C.
USPM	University of Minnesota, St. Paul, Minnesota
UWO	University of Western Ontario, London, Ontario
YPM	Yale University's Peabody Museum of Natural History, New Haven, Connecticut

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Generic Diagnosis and Morphology of the Imago

ANISOTA HUEBNER

Anisota Huebner, 1820: 192; Michener, 1952: 409. Type species: *Bombyx stigma* Fabricius, designated by Grote, 1874: 260.

A North and Central American genus of small to medium sized moths of brownish color; always with extremely reduced clypeus in the adult and a white discal spot on the forewing; the male in many cases diurnal; strong sexual dimorphism in some of the species, some sexual dimorphism in all species. Morphological features which all species of the genus have in common as adults are:

a) male antennae doubly bipectinate; female antennae simple and ciliate
b) epiphysis in many females absent, not as Michener (1952: 408) and Ferguson (1971: 63) say in *all* females; Michener's own preparation (AMNH) of an anterior leg of a female of *A. virginiensis* has an epiphysis; when present much reduced in size
c) anterior tibia in male and female dorso-apical with two lateral projections, the exterior one usually a long spine, the interior one a much shorter and usually blunt projection; middle and posterior tibiae also with two projections of this kind, but much shorter and in many cases similar in size; middle and posterior tibiae in males and females bear one pair each of tibial end-spurs; a pair of peculiar spines in the females only arises from the apical lobes of the penultimate anterior tarsal segment. Leg morphology is described and figured by Oiticica (1940).
d) pulvillus, paronychium (lateral lobe) and empodium (generally only one tubercle with one long strong seta) well developed
e) free anellus in male genitalia present and valves not fused
f) uncus of male genitalia without protuberance

Michener (1952) says of *Anisota*: "This subgenus includes most of the species of *Anisota*. They are brown, with a small white spot at the apex of the discal cell of the forewing. It includes two rather well-marked groups of species distinguished primarily by the size of the eyes. In *dissimilis* Boisduval and *oslari* Rothschild the eyes are reduced in size so that their upper ends do not reach the lower margins of the antennal sockets, and their lower ends do not reach the lower extremity of the frons. In this group, moreover, the frontal protuberance is more reduced and the proboscidial fossa is even shallower than in the other group which contains the remainder of the species. In *dissimilis* and *oslari* also the labial palpi are more distinctly two-segmented than in the remaining species of the genus. The species of this subgenus occur in eastern North America, westward to Arizona and south into Mexico."

The basic premise of the foregoing is valid. The species of *Anisota* can indeed be separated into two groups with the aid of the size of the eyes, or of a certain ratio of the head and the position of the eyes or of the form of the frontal protuberance, or on the basis of the visibility or obscuration of the laterofrontal suture. All of these criteria give rise to identical groupings, and it should be taken into account that it is not so much the size of the eyes as their position and angle to the head which makes the difference, and which makes the eyes *appear* to be of quite different size. To compare eyes of these moths without exact measurements gives very wrong results; Ferguson (1971: 74) mentions the "very small eyes" of the males of *A. senatoria*. It is in fact astonishing that exact measurements of the eyes do not show a great difference among the species, except for *A. virginiensis* which was included by Michener among the "big-eyed" species and actually has the smallest eyes of the entire genus, as correctly pointed out by Ferguson (1971: 74). On the other hand, the eyes of *A. dissimilis* and *A. oslari* are in no way "very reduced" as Ferguson (1971: 64) says. Table 1 of the eye measurements will better illustrate these points.

TABLE 1

Eye Measurements (in mm)

Species	**a-b in male**	**a-b in female**	**c-d in male**	**c-d in female**
Group A				
A. consularis	1.30	1.31	0.70	0.65
A. fuscosa	1.70	1.56	1.09	0.96
A. manitobensis	1.43	----	0.87	----
A. senatoria	1.33	1.24	0.70	0.62
A. stigma	1.37	1.44	0.97	0.95
Group B				
A. assimilis	1.23	----	0.67	----
A. discolor	0.98	----	0.50	----
A. dissimilis	1.23	----	0.70	----
A. finlaysoni	1.17	1.17	0.67	0.63
A. oslari	1.14	----	0.55	----
A. peigleri	1.33	1.33	0.60	0.80
A. pellucida	1.04	1.21	0.55	0.72
A. punctata	----	----	----	----
A. virginiensis	0.93	1.08	0.50	0.53

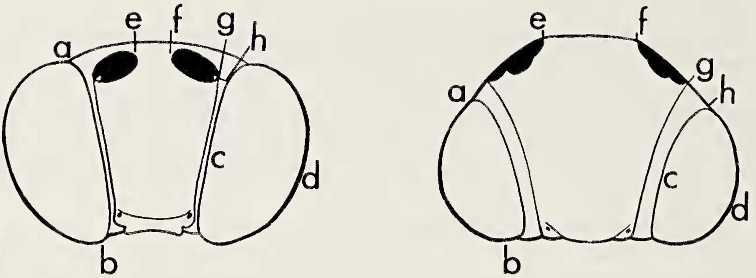

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Fig. 1. The two types of heads in *Anisota*, with large and small eyes. See Tables 1 and 2.

The table clearly shows group A with the large eyes and group B with the small eyes. In group A the measurement a-b does not go significantly below 1.33 mm while in group B it does not go over 1.33 mm. In group A the measurement c-d does not go below 0.70 mm while in group B it does not exceed 0.70 mm. Females show slight differences with the males; in group A their measurements tend to be lower than in the males while in group B they tend to be slightly higher. Regrettably there were not enough females available to check every species. In group A the eye measurements separate *A. fuscosa* from all the other species, especially from the closely related *A. stigma*. In group B, *A. peigleri* shows a slight deviation with a-b the highest for the group and c-d just in the middle between the highest and lowest values.

Further examination has shown that in no species the eye reaches the antennal socket at all. To see this clearly the head should be detached, cleaned and measured. If this is done, one finds that the distance between the two antennal sockets (e-f) and the distance between one antennal socket and the upper edge of the eye (g-h), give a ratio which can be very useful in connection with the values of Table 1. See Table 2 and Figure 1. The data in Table 2 corroborate the conclusions from Table 1, namely there are two groups of *Anisota* species which can be separated by certain eye and head measurements. It is also remarkable that visibility of the laterofrontal suture and the size of the frontal protuberance support the groupings established with our measurements. It is interesting to note that *A. fuscosa* also deviates here by far from the normal values while everything otherwise falls nicely into place. Because of the dissection necessary and the scarcity of some species in collections, it was possible to measure for some species only one specimen, but in the other species where a series of measurements was taken, the variation was very small, indicating that the single ones measured are probably representative of their species, at least in the present context.

The labial palpi show for the entire second group a more distinctly two-segmented condition than in the first group.

Many specimens were dissected as to the genitalia and other anatomical features; also Michener's dissections (AMNH) were used. The form of the aedoeagus of the male genitalia can be furthermore used to divide the second group into two subgroups: *A. dissimilis, A. finlaysoni, A. oslari,* and *A. peigleri* have a straight

TABLE 2

Head Morphology
(numbers in mm)

Species	ratio of male	e-f:g-h female	laterofrontal suture	frontal protuberance
Group A				
A. consularis	3.6:1	3.1:1	slightly obscured	very prominent
A. fuscosa	6.7:1	6.0:1	obscured	protruding
A. manitobensis	3.3:1	-----	absolutely obscured	prominent
A. senatoria	3.0:1	3.2:1	slightly obscured	protruding
A. stigma	3.6:1	3.3:1	obscured	protruding
Group B				
A. assimilis	2.0:1	-----	visible	reduced
A. discolor	1.7:1	-----	visible	reduced
A. dissimilis	1.8:1	-----	visible	reduced
A. finlaysoni	1.8:1	2.7:1	visible	reduced
A. oslari	1.9:1	-----	visible	reduced
A. peigleri	1.8:1	-----	visible	slightly protruding
A. pellucida	1.8:1	1.8:1	visible	reduced
A. punctata	-----	-----	-----	-----
A. virginiensis	1.7:1	1.8:1	visible	reduced

aedoeagus, while *A. assimilis, A. discolor, A. pellucida,* and *A. virginiensis* have the aedoeagus curved. In the first group the aedoeagus is straight in all species. It is noteworthy that the female genitalia, which were not studied by Ferguson (1971), also support the above grouping: only the *A. assimilis* subgroup has a prominent antrum and this is of an unusual form when seen in lateral view (Figure 8), and in all species of the second group the ductus bursae makes an abrupt, almost rectangular turn where the bursa copulatrix is attached. In all species of the first group the ductus bursae is straight.

In some species of the genus a special sexual dimorphism occurs as a parallel development in both groups. This character has been used by previous authors for the purpose of subdivision of the genus into species groups. However, this seems to be artificial and untenable and it should be recognized that other morphological features form a better basis for a natural grouping of similar species within *Anisota*. For a correct interpretation of the somehow striking sexual dimorphism see Ferguson (1971: 63). Some diurnal males have evolved very transparent forewings (*A. pellucida, A. discolor, A. virginiensis*) or tend toward that (*A. senatoria, A. peigleri*); other diurnal males (*A. oslari*) show no such trend but nonetheless probably also resemble orange wasps (Vespidae) in flight.

It does not seem justifiable to correlate reduction in eye size with a trend to diurnal activity (see Ferguson, 1971: 63). Our Table 1 shows clearly that there are small eyes among species with sexual dimorphism as well as among those without, and the same is true for large eyes. It is also important to consider the statement of Mazokhin-Porshnyakov (1969: 2): "As a rule, the mobile and fast flying species, both diurnal and nocturnal, have large complex eyes; male insects often have bigger eyes than females."

Morphology of the Immature Stages

Egg. This is, according to Packard (1905): "elliptical, flattened, each end alike, a little longer than broad, shell very thin, parchment like, the surface with obscurely marked microscopic irregular hexagonal areas. The eggs are laid in large patches on leaves". We add: patches on older leaves with preference at apices of leaves on the lower perimeter of the tree.

Larva. Larvae, according to Packard (1905) with "body cylindrical, slightly flattened at the end; armature consisting of two recurved slender smooth mesothoracic horns [except for *A. finlaysoni*]; prothoracic spines reduced to low tubercles;all other dorsal and lateral spines of the body small, conical, acute; the two dorsal spines of the eighth abdominal segment, remote, not fused into a caudal horn. Suranal plate rugose or granulated, with from three to four lateral and two terminal stout conical spines. Body with conspicuous longitudinal bands or stripes." The latter, however, is not always the case. The headcapsules and suranal plates are specific and figured as far as possible. Here it should be noted that in Peterson (1959: Fig. L 12) the captions of H and C should be interchanged, i.e., H should read "*A. senatoria*" and C should read "*A. stigma*".

Pupa. About the pupa Mosher (1916) (see also Mosher, 1914) says: "Without prominent scattered spines on the thoracic segments, the longest never four times the length of those covering the segments; antennae with the central axis never bearing pominent spines, the spines never curving posteriorly; maxillae always one-fourth the length of wings". We provide figures of the species-specific cremasters of species for which these were available. These structures have been shown to be taxonomically useful (Giehsler, 1965).

Intrageneric Classification and Phylogeny

Different groupings may be derived for the 15 species of *Anisota*, depending on characters used. Eye size and head morphology discussed earlier give one such arrangement, whereas genitalia give another. However, we prefer the following groupings based on habitus of larvae and adult moths as well as geographical distributions:

A. stigma group

A. stigma
A. fuscosa
A. consularis
A. manitobensis

A. senatoria group

A. senatoria
A. finlaysoni
A. peigleri

A. pellucida group

A. pellucida
A. virginiensis
A. discolor
A. leucostygma

Mexican group

A. dissimilis
A. punctata
A. assimilis
A. oslari

Certain features of the zoogeography are clear while others are difficult to ascertain. The genus evidently originated in Mexico or southward, possibly as specialized feeders on oaks. The distribution and numbers of species in North America was likely greatly influenced by glaciation and other climatic changes during the Pleistocene.

Larger size of the adults, very spiny larvae, south Mexican distribution, and nocturnalism are judged to be plesiomorphic characters (based on outgroup comparison) in such species as *A. dissimilis*. Both *A. dissimilis* and *A. punctata* show affinities with the *A. stigma* group; *A. assimilis* shows a relationship to the *A. pellucida* group through the genitalia. All of the species appear to be still very closely interrelated and the above four groupings merely indicate still closer affinities. It is likely that there remain undiscovered species in Mexico or southward. Lepidopterists have traditionally collected most heavily in lowland rainforests where the fauna *seems* richer, and *Anisota* are more likely encountered in oak-pine biotope in the mountains. If new species are described from the United States or Canada in the future, these will likely be ones which are presently "hiding" under names of widespread and variable species such as *A. stigma, A. virginiensis,* and *A. senatoria.*

The phenomenon of allopatry is quite evident with the most closely related species. When species are so alike in their ecological requirements (i.e., fill the same niche), then they are mutually exclusive or ecologically antagonistic, possibly due to competition or more likely the absence of isolation mechanisms to prevent hybridization (see Mayr, 1969, p. 193-197; Stebbins, 1969). Such allopatry or parapatry have led workers to consider that some of these species are merely subspecies. Our observations indicate that all 15 taxa which we herein recognize are full, discrete species. We have noted consistent differences in genitalia of both sexes, adult phenotype and leg morphology, larval color and morphology, pupal morphology, egg size and embryo development; and in the *A. pellucida* group we have observed sterility and inviability in F_2 and backcrosses of artificial hybrids. Furthermore we find no indications of blend zones or clines, despite the immense amount of material examined. Van Valen (1976) offers an interesting discussion on these matters.

To elaborate on this important concept of allopatry let us view some specifics. Any given locality tends to have only one representative from a given group: in New Jersey one will collect *A. stigma, A. senatoria,* and *A. virginiensis*; in upper South Carolina one collects *A. stigma, A. peigleri,* and *A. pellucida*; in East Texas we find *A. fuscosa, A. senatoria,* and *A. discolor.*

Although we do not promote usage of common (vernacular) names for these insects, a few remarks may be appropriate here. According to one list (Benoit, 1975) the English and French common names for four species are: *A. finlaysoni*, shorthorned oakworm, anisota de Finlayson; *A. senatoria*, orange-striped oakworm, anisota a lignes orangees; *A. stigma*, spiny oakworm, anisote stigma; *A. virginiensis*, pink-striped oakworm, anisote rose du chene. Holland (1903) refers to *A. virginiensis* as "the Virginian Anisota" and *A. stigma* as "the Stigma Moth". Names such as spiny, pink-striped, and orange-striped oakworms have become less appropriate with the discoveries of more species in recent years, since each name might apply to an entire group of species.

The species of *Anisota* are arranged alphabetically in the text for convenient reference in their groups: Mexican group - *pellucida* group - *senatoria* group - *stigma* group.

Key to Adults

1. antennae doubly bipectinate (males) 2
   antennae simple and ciliate (females) 5
2. forewings with hyaline area around discal cell 3
   forewings without hyaline area around discal cell 4
3. medium reddish brown; outer margin of both wings perceptibly convex; anal angle of hindwings all rounded; aedoeagus of male genitalia rounded . . . . **A. virginiensis**
   deep reddish brown; outer margin of both wings straight or nearly so; anal angle of hindwings not rounded; aedoeagus of male genitalia more slender and oblong. . . . . **A. pellucida**
   deep yellowish brown or soft brown; when fresh with a slight grayish hue; outer margin of both wings convex; anal angle of hindwings strongly rounded; aedoeagus of male genitalia rounded, more narrow than in *A. virginiensis* but a little wider than in *A. pellucida*, proximal end straight . . . . **A. discolor**
   medium yellowish brown; outer margin of forewing slightly concave (between M_2 and Cu_1b), of hindwing straight, anal angle of hindwing almost rectangular . . . . **A. finlaysoni**
   light brown or soft brown; sprinkling with dark scales strong; outer margin of foreing perceptibly convex, of hindwing straight; anal angle of hindwing rounded; only known from Florida and Georgia . . . . **A. consularis**
   medium reddish brown (North) or soft reddish brown (South); outer margin of both wings almost straight; anal angle of hindwing not at all rounded; aedoeagus of male genitalia straight . . . . **A. senatoria**
   medium reddish brown; sprinkling with dark scales strong; hyaline patch covered with scales to some extent; discal spot large; margin of hindwing straight . . . . **A. peigleri**
4. forewing brownish orange; hindwing dark blackish brown, venation of forewing the color of hindwing; abdomen blackish brown; Mexico only . . . **A. dissimilis**
   male still unknown; probably somewhat similar to the above species, Mexico only . . . . **A. punctata, n. sp.**
   forewing deep reddish orange; hindwing soft reddish brown; Mexico, Arizona to western Texas . . . . **A. oslari**
   unicolorously gray reddish orange with a slight tinge of reddish in hindwing; Mexico only . . . . **A. assimilis**
   color of both wings deep orange to brownish orange; strongly sprinkled with dark scales; outer margin of both wings entirely rounded, especially apex of forewing . . . . **A. stigma**
   color of both wings deep orange yellow to medium yellow brown with little contrast; strongly sprinkled with dark scales; outer margin of forewing slightly straightened and not rounded at apex; eyes strikingly large . . . . **A. fuscosa**
   strong medium reddish purple suffusion on both wings, basic color brownish orange; only Manitoba to Wisconsin . . . . **A. manitobensis**
5. connection (ductus bursae) between ostium bursae and bursa copulatrix straight 6
   this connection not straight 7
6. deep orange yellow; wings semitransparent in most specimens; usually only slightly sprinkled with dark scales; outer margin somewhat straightened

between M_3 and apex; postmedian band usually quite visible; ductus bursae obviously slender.. **A. senatoria**

deep orange yellow to brownish orange; wings very strongly sprinkled with dark scales; outer margin of both wings well rounded................ **A. consularis**

deep orange; wings opaque; strongly sprinkled with dark scales; outer margin of both wings well rounded.. **A. stigma**

almost uniformly medium orange colored with a slight pinkish tinge on the hindwing; Mexico only.. **A. assimilis**

7. brownish orange strongly suffused with purplish, especially in basal and terminal areas; ductus bursae only slightly bent to the left; Manitoba to Wisconsin.. **A. manitobensis**

deep orangish yellow forewing; hindwing duller, somewhat suffused with blackish-brown; venation on both wings of same color; abdomen blackish-brown, joints of segments outlined in ochreous brown; ductus bursae sigmoidal; Mexico only.. **A. dissimilis**

brownish orange on forewing; medium orange hindwing; venation not pronounced; abdomen tawny olive-ochreous; head and thorax same; postmedian lines very strongly developed; strongly sprinkled with dark scales.. **A. punctata**

light brown with a light ochreous tinge; hindwing slightly darker; ductus bursae sharply bent to the left; Mexico, Arizona to western Texas......... **A. oslari**

unicolorous deep orange yellow to medium yellow brown; strongly sprinkled with dark scales; outer margin of wings as in male; ductus bursae twisted twice; eyes strikingly large.. **A. fuscosa**

soft yellow; outer margin only slightly rounded between Cu 1b and apex; postmedian lines on both wings straight; but weak; purplish suffusion in terminal area very reduced; ductus bursae twisted upwards.... **A. finlaysoni**

deep orange yellow; mostly strongly sprinkled with dark scales, marginal area of forewing purplish; outer margin almost straight; large (25-30 mm); ductus bursae twisted twice.. **A. peigleri**

considerable contrast between gray purplish pink terminal area and remainder of wing brownish orange or wine colored; rarely with dark scales; ductus bursae sharply bent to the left.................................... **A. virginiensis**

wings opaque and occasionally with dark scales and strongly colored medium reddish brown; ductus bursae bent to the left directly cephalad of antrum....... ....**A. pellucida**

monotonous light brown to dark orange yellow; sometimes with grayish overtones; often sprinkled with dark scales; bursa copulatrix very slightly bent off of ductus bursae.. **A. discolor**

size large; deep orange yellow; terminal area of forewing slate; ductus bursae twisted twice; Central America................................ **A. leucostygma**

Key to Mature Larvae

1. not unicolorous.. 2
   unicolorous.. 3
2. in two colors (light gray olive and deep pink) evenly and widely striped; thoracic horns 6 mm long; head deep yellow.......................... **A. virginiensis**
   in two colors (dark greenish yellow and deep pink); thoracic horns 6 mm long; head deep greenish yellow.................................... **A. pellucida**

in two colors (dark olive and very deep red); not quite evenly striped; thoracic horns 8 mm long; head medium olive. . . . . **A. discolor**
first three abdominal segments yellow, following ones reddish brown; thoracic horns long and blunt on tips; black spots between abdominal segments; head yellow. . . . . **A. dissimilis**
3. unicolorous black. 5
other color. 4
4. color soft red with broken yellow stripes; body very strongly granulated; thoracic horns 5.5 mm long; head deep orange. . . . . **A. oslari**
color various shades of brown, densely covered with pinkish white granulations of uneven size; laterally paler stripes only faint; thoracic horns 7 mm long; head brownish orange. . . . . **A. stigma**
color light brown, on each segment a very wide black saddle; on saddle pinkish white granulations of uneven size; thoracic horns 5 mm long; head deep orange yellow. . . . . **A. assimilis**
color medium orange to light brown; body covered with many white spots and ecrescences; dorsal, lateral, supraventral brownish stripes; gray dorsal band; thoracic horns clubbed, 5 mm long; head brownish orange. . . . . **A. fuscosa**
color medium orange with lighter brown stripes; thoracic horns 6 mm long; head pale tan. . . . . **A. manitobensis**
color various shades of tan, with numerous longitudinal thin black stripes; thoracic horns ca. 6 mm long; head brownish orange. . . . . **A. consularis**
5. with very orange yellow continuous stripes; thoracic horns 4 mm long; head blackish red brown. . . . . **A. senatoria**
with sometimes faint, interrupted very orange yellow stripes; subspiracular "ornaments" much reduced; thoracic horns 6.5 mm long; very spiny; head black. . . . . **A. peigleri**
with brilliant orange yellow continuous stripes, no thoracic horns except a pair of short scoli 1 mm long; head black. . . . . **A. finlaysoni**

Note: The names of colors used in the foregoing keys follow those given in the Inter-Society Color Council—National Bureau of Standards, Circular 553.

Ecology, Collecting in the Field, and Rearing in Captivity

Rearing and collecting the various species of *Anisota* is an integral part of studying them. These activities can be very profitable because it is generally easy to collect larvae on trees and adults at lights. The larvae are rather easy to rear in captivity. The senior author has studied the species in southeastern Ontario; the junior author has collected from North Carolina to Florida across to Texas and in Mexico and Ontario.

Searching for ova is generally unproductive unless one is in an area where high populations exist of one or more of the species. It is then best to search on the undersides of oak leaves not too high from the ground. The heavy females do not oviposit in the tops of trees unless the tree is only a couple meters high. Isolated trees, or those along a forest-field interface are good places to search. Trees near lighted areas (such as rest areas on major highways) which attracted female moths are more likely to have ova and larvae. Larvae begin feeding on the leaf which bore the ova so it is advisable to look for chewed leaves on ends of branches. When larvae only a few days old are found in this manner, the egg patch is also present nearby. The remaining ova may contain ovarian parasites.

Larvae of *Anisota* are gregarious all through life, especially in the early instars. Young larvae spin invisible silk mats to aid aggregating behavior. Mature larvae will spread out over an entire small tree but on large trees they all are generally on one or few branches, still relatively near each other. When a collector begins to detach larvae which he has found, the adjacent ones detect the danger and drop to the ground; even larvae in molting position will drop. Larvae are very easy to remove from branches, never hanging on tightly as in many Saturniidae. Molting larvae detached from their silk pads almost always molt successfully, even in the bottom of a glass jar. Larvae sit on twigs in clusters in the position of sphingid larvae, with the anterior end raised. Brodie (1929) described and figured this behavior. Larvae also will sometimes sway rapidly from side to side in unision when disturbed. This behavior is not understood. To collect the largest larvae among a colony is to collect mostly females. It is tempting to take large ones because one figures that less rearing work will remain to be done. Male larvae, being smaller, mature sooner and leave the tree several days earlier than their female siblings.

Since the defoliation is usually quite noticeable, it can be productive to look for colonies while driving along a road, but sometimes, in the Southeast at least, the defoliators turn out to be colonies of *Datana* spp. (Notodontidae). First-instar larvae of *Datana* skeletonize leaves, unlike *Anisota*. Other times the larvae of *Anisota* have left the tree already to pupate. If the defoliated branch has begun to recover by producing new leaves, one can assume the larvae left weeks earlier. If no new leaves have yet formed, it is often possible to find a few straggling larvae, or at least some exuviae, to determine which species had been present. We have observed that the same individual trees, indeed certain lower branches, are defoliated year after year by the same species of *Anisota*.

Larvae of certain species of the genus are not well camouflaged. The coloration of those species such as *A. senatoria* (black with orange stripes) is apparently aposematic. Immunity to avian predation may be due to the tough spiny texture of the caterpillars and/or to possible toxic substances, such as tannins derived from oak leaves.

It is incorrect to assume that *Anisota* are found on any oak. All oaks are accepted freely in captivity; larvae will feed on a mixed diet of several oak species with no hesitation. The tough evergreen oaks such as live oak (*Quercus virginiana* Miller) are eaten freely as well as the species of *Castanea*, the chestnuts and chinkapins. Possibly the nearly extinct American chestnut (*Castanea dentata* (Marshall) Borkh.) was a major host in the past. Species of *Quercus* with tough, pubescent, or evergreen leaves are generally the least preferred in nature. In an area with several species of oaks, one will find some species attacked growing among others unattacked. Ovipositing females are apparently very discriminating. In the Southeast (North Carolina to Florida to East Texas) the two favorites are undoubtedly water oak (*Q. nigra* L.) and southern red oak (*Q. falcata* Michaux). The former is commonly planted in yards and parks and may be heavily defoliated. Other favorites are *Q. marilandica* Muenchh., *Q. velutina* Lam., *Q. phellos* L., *Q. palustris* Muenchh. and similar species. *Q. alba* L., *Q. stellata* Wang., and *Q. virginiana* are not frequently attacked. However, in extreme southern Florida it is probable that *Q. virginiana* is a usual host because other oaks are not available. Likewise in Texas, west of the forested areas of the eastern part of the state, the *Anisota* are obliged to live on *Q. stellata*, the most prevalent oak. In France, Dr. Claude Lemaire has reared

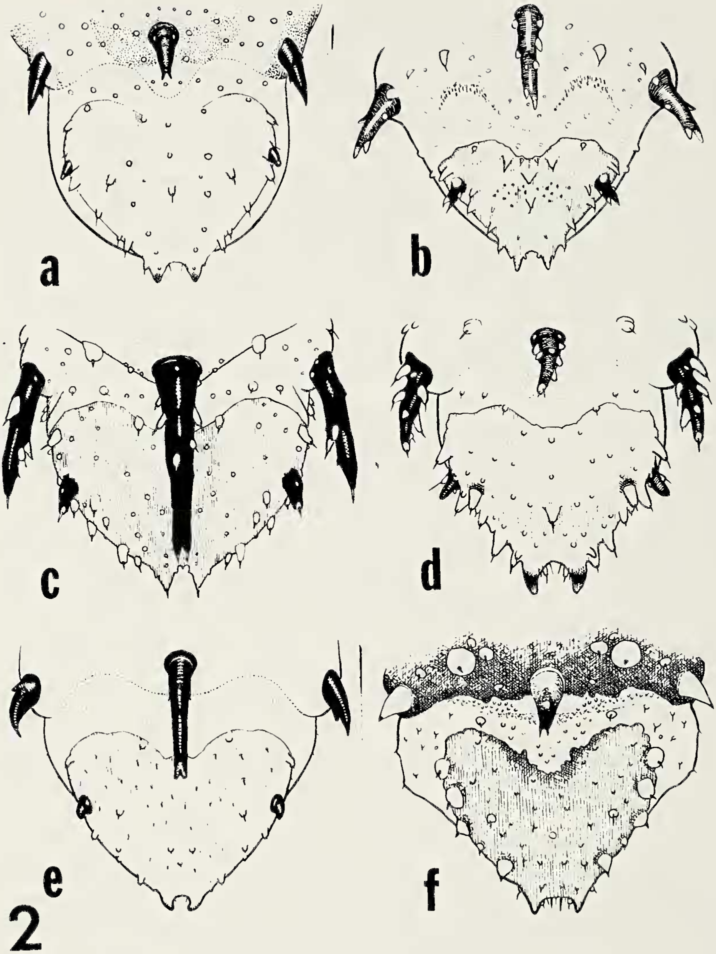

Fig. 2. Suranal plates of mature larvae: a. *A. stigma,* b. *A. fuscosa,* c. *A. consularis*, d. *A. manitobensis*, e. *A. oslari*, f. *A. assimilis*.

species of *Anisota* from the Atlantic states with a little difficulty on *Q. pubescens* Willd., a species similar to *Q. stellata*, but found that larvae of *A. discolor* from Texas did especially well on that host. Tough and/or pubescent leaves are more offensive to very young larvae. Reports of larvae eating hazel (*Corylus*) (Packard, 1905; McGugan *et al.*, 1958) we believe to be correct.

It is also apparent that the hot, dry, sandy, scrub-oak areas, so suitable for *Hemileuca* (Saturniidae), are not suitable biotope for *Anisota*. These areas include turkey oak (*Q. laevis* Walter) and myrtle oak (*Q. myrtifolia* Willd.) growth from central South Carolina down through Florida and the limestone hills with *Q.*

fusiformis Small in central Texas. *Anisota* are sometimes collected in such areas, but the populations are very low, if at all present.

When larvae have finished feeding they drop to the ground and begin to wander for a day or so in search of a place to enter the ground to pupate. Collecting of larvae crawling on the ground is desirable because no further feeding is required by such larvae, but some parasitism should be expected. It is virtually impossible to locate pupae in the soil so we recommend the collector not waste his time in such an endeavor. Nematodes may attack pupae in the soil but we have no records for this. Pupal mortality may also be caused by occasional flooding or droughts.

The best method for collecting adult moths is to attract them with ultraviolet or mercury vapor lamps (such as street lights). One can hang an ultraviolet light or lantern in front of a sheet. White light sources near a brick wall or similar surface (the lighter colored the substrate is, the better) are very suitable places to find adults because a suitable resting place is available to the moths after arriving at the light. Adults which have been at rest are very lethargic and thus easily captured; they will drop into a box or killing jar if gently pushed. Females of *A. peigleri* arrive at light just at dark whereas males of *A. stigma* may not arrive until 2:00 AM (EST). Most adults are available under lights before midnight except, of course, those species with diurnal males which are rarely taken at lights. The earlier in the day that the male flies, the fewer at light: we know of only one male *A. pellucida* taken at light. The rare cases where diurnal males are found at light may involve individuals which were brought there by the larger females, the female flying to the light before copulation had terminated. This is only a theory but often pairs are found near each other under light sources.

Males can be attracted to females which will emit pheromone in captivity. We believe that the pheromone is the same, or about the same, for all the species (see our remarks under "Artificial Hybridization"). Therefore a female of any species may attract males of any other species, provided that she emits pheromone at the right time of day or night, during the correct season, and in the right location. Hybridization of the species in nature is prevented by allopatry, different flight times of day and night, and/or different flight times through the year. Adjusting of the photoperiod with artificial light or darkness allows one to induce a female to emit pheromone at any desired time. Assembling males are rapid fliers, and a net is usually necessary to capture them.

Several handbooks are available to provide information on rearing caterpillars. Consequently, we only wish to give here a few remarks peculiar to, or important in, the rearing of *Anisota*. Larvae are easy to rear but tend to stunt easily when reared in containers on cut food and the result is undersized adult moths. Best rearing is done in large cloth bags on limbs of oaks because such growing food provides more nutrition than cut food. Also ventilation and sunlight should reduce incidence of disease in a brood. However, once larvae stop feeding they cannot be left in the bags to pupate as with cocoon-spinning species. There is no evidence that a diet of several oak species produces larger or healthier larvae. Humidity may be advantageous.

Although most lepidopterists prefer to let larvae which pupate subterraineously burrow into a container of soil, this is not at all necessary. Contracted larvae pupate quite successfully in any container, with no soil, or they can be placed on a layer of moist sand or peatmoss. Summer pupae destined to produce adults in less than one month generally do very well if simply kept from dessication. However, with diapausing (over-wintering) pupae one should expect some mortality. One method which the junior author uses is to keep pupae on a layer of moist-to-wet sand in a plastic shoebox in the refrigerator (ca. 4-5°C) all winter. A too tight lid results in molding; too open causes dessication; both will be fatal to the pupae. Misting of pupae with water triggers emergences.

The diapause is apparently broken by longer day length rather than higher temperatures. *Anisota*-pupae kept at room temperature (ca. 25°C) all winter still produce adults at the normal emergence time in many cases. Pupae kept under laboratory conditions sometimes yield adults in autumn or spring, while summer is the normal flight time for the particular species. It is possible that the diapause is attuned to specific needs in the phenology such as host plant requirements. Even in the milder climates, larvae of *Anisota* strongly tend to be late season feeders. In such areas there is ample time for another generation but this does not occur. Probably larvae of the genus require mature oak leaves. Other lepidopterous larvae require spring foilage of oak. The levels of proteins, carbohydrates, and tannins in oak leaves change through the seasons. The excellent study by Feeny (1970) will provide the reader with more information.

When adults emerge the rearer may wish to obtain matings or cross-matings. Males can be kept refrigerated for several days until a female is available. The container in the refrigerator should have a damp cloth. Such chilled males will become active within a few minutes after being taken from refrigeration, and will mate quickly with a female which is emitting pheromone. Females which are chilled in this manner however, usually fail to emit pheromone afterwards. Hand-pairing has not been successful with the small adults.

A problem is encountered if one tries to hold adult moths for long periods at room temperature. Emergences from pupae are in morning or mid-afternoon, depending on species and geographic location, and the moths of both sexes commence to flutter at dusk. If specimens are needed for a collection but one is also hoping to obtain pairings, we recommend that they be kept beside a lamp all night while alive. Another practice used to prevent wing damage can be tried with females after they have mated. This is to put them into envelopes with wings folded back while ovipositing. While this method works well for large saturniids, the females of *Anisota* seem to prefer to flutter some and more eggs will probably be obtained from a female kept in an open container. The presence of oak foliage does not appear to increase oviposition. It is likely that almost all females of Saturniidae taken at lights have mated and will thus lay fertile ova. This usually appears to be true for females of *Anisota*, but not always. Some individuals oviposit freely; others do not, even if mated.

The rearer choosing to send out ova to enable others to rear larvae should keep in mind the remarks of Hitchcock (1961b), i.e., first-instar larvae have higher mortality in smaller groups. The very young larvae apparently work as a team in cutting the oak foliage. Therefore, it is best to supply at least 30 ova to another rearer.

Population levels or densities may be estimated in an area by abundance of larval colonies or by numbers of adults taken at lights. The two do not always appear to "agree" however. For example, in northwestern South Carolina *A. peigleri* is consistently abundant as a larva but adults are taken only occasionally at lights. In the same area larvae of *A. stigma* are difficult to find but adults are abundant at lights. The apparent discrepancy is explained by the fact that females are taken at

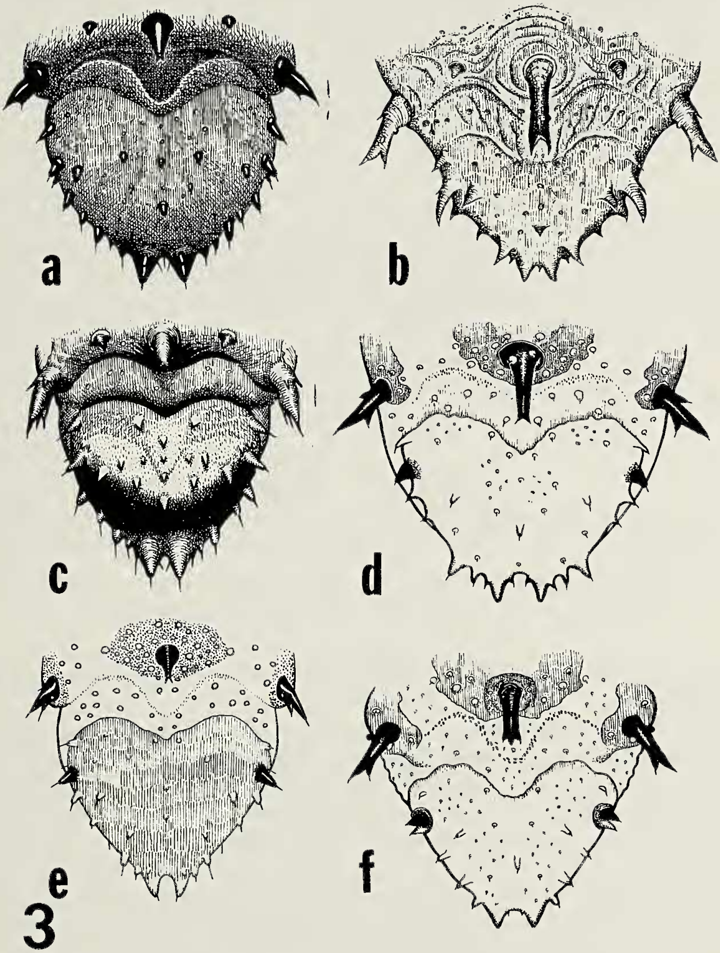

Fig. 3. Suranal plates of mature larvae: a. *A. senatoria*, b. *A. peigleri*, c. *A. finlaysoni*, d. *A. pellucida*, e. *A. virginiensis*, f. *A. discolor*.

light less often than males, and males of *A. peigleri* are diurnal. Therefore, many males of *A. stigma* are collected at lights, some females of both species, and rarely any males of *A. peigleri*.

Females of some species such as *A. senatoria* and *A. peigleri* deposit high numbers of ova in one place, and this contributes to the ability of such species to become pests by extensive defoliation. Larval colonies of other species such as *A. stigma* and *A. pellucida* usually contain less than 25 larvae. If fecundity of all species is roughly

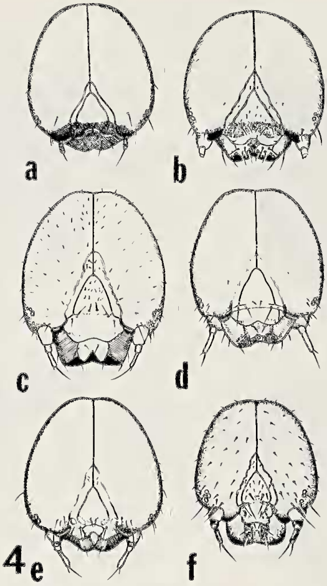

Fig. 4. Head capsules of mature larvae: a. *A. stigma*, b. *A. fuscosa*, c. *A. consularis*, d. *A. manitobensis*, e. *A. oslari*, f. *A. assimilis*.

equal, we can assume females of the latter species oviposit in more sites, but fewer eggs per site.

In Florida and coastal Georgia, populations of *A. pellucida* are consistently high. *Anisota peigleri* has maintained a very high population in upper South Carolina for at least 12 years; in East Texas the same appears to hold for *A. senatoria*. The sporadic outbreaks of *A. senatoria* in New England are a very different phenomenon. In this case we would use the ecologists' term "fugitive species" for *A. senatoria*. Fortunately, *Anisota* is a group which is not especially harmed by human interference such as habitat destruction, since the various species live well in yards and parks where oaks are planted, as well as in the countryside. Conservation of populations of *Anisota* may become necessary however. Hessel (1976) mentions *A. finlaysoni* as suffering from habitat destruction. Indeed we have noted an absence of records for this species between Toronto and the type locality and suspect that agricultural practices have destroyed most oaks in that area. Many forest entomologists consider *A. senatoria* to be a pest such as Ignoffo *et al.* (1973) in Missouri and Hitchcock (1958, 1961a) in Connecticut. Large scale sprayings with chemicals or pathogens should be used only where absolutely necessary. The aerial application of spores of *Bacillus thuringiensis* Berliner is hailed as harmless to the environment by entomologists attempting to control populations of the gypsy moth (*Lymantria dispar* (L.), Lymantriidae). That claim is absurd since the pathogen kills many non-target species of Lepidoptera.

Collecting of material throughout the range of the genus is needed to augment what is known about the group. Amateur lepidopterists can make significant contributions by preserving adults and associated larvae from localities where they collect. Data are especially needed for circadian flight times of even the common and widespread species. Some of the aforementioned field observations may only be applicable to the southern states, creating the need for information on some northern populations for comparison. The lack of material and information for the Mexican species is particularly obvious. The mechanisms of diapause in *Anisota* are poorly understood. It is hoped that our information in this section will stimulate additional research by others.

Parasitism

During the larval stages, the species of *Anisota* are much more vulnerable to attack by parasites than predators. The known parasites all belong to the orders Diptera and Hymenoptera. Records for parasitism in species in the northeastern states (*A. stigma, A. senatoria, A. virginiensis*) can be found in Schaffner & Griswold (1934) and Muesebeck *et al.* (1951). For tachinid parasitism one can do no better than to consult Arnaud (1978). The junior author has reared parasites from *Anisota* in the southern states and a list of these plus notes on their habits follows. Our records from Maryland were provided by Robert T. Mitchell.

Diptera

Tachinidae: Goniinae

Lespesia datanarum (Townsend) (= *Achaetoneura anisotae* Webber). In *A. pellucida* from Martin, Florida; Ludowici and Statesboro, Georgia; in *A. peigleri*

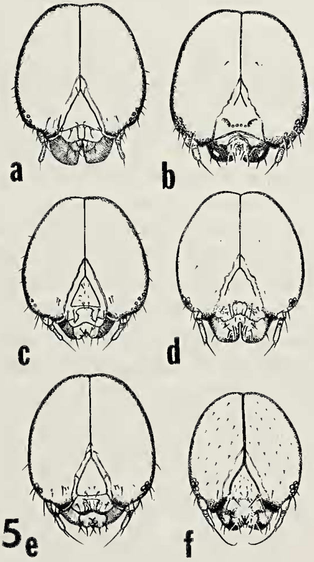

Fig. 5. Head capsules of mature larvae: a. *A. senatoria*, b. *A. peigleri*, c. *A. finlaysoni*, d. *A. pellucida*, e. *A. virginiensis*, f. *A. discolor*.

from Clemson, Greenville, and Westminster, South Carolina. The ovipositing flies deposit their eggs on a larva and the maggots feed inside the host, emerging to pupate in soil after the host has pupated. Parasite puparia will generally diapause at the times that the host species does. Usually there is one to three parasites per host.

Eumasicera sternalis (Coquillett). In *A. consularis* from Statesboro, Georgia and in *A. virginiensis* from Pine Grove, Pennsylvania. These flies have a life-cycle much like *L. datanarum* but the adults are lighter gray and smaller.

Belvosia bifasciata (Fabricius). In *A. senatoria* and *A. discolor* from Walker Co., Texas. (What is apparently this species has been reared from *A. assimilis* by R. O. Kendall from Chihuahua.) These large flies have yellow-tipped abdomens and can be seen flying around defoliated oak trees in the autumn searching for hosts. The phenology is similar to *L. datanarum* but these are solitary (gregarious in larger hosts such as *Eacles*) parasites and the maggot does not leave the host pupa to pupate.

An undetermined species of Tachinidae attacks *A. finlaysoni* in St. Williams, Ontario (size of *Lespesia*, puparium obtained only; specimen in Royal Ontario Museum).

Hymenoptera

Trigonalidae

Poecilogonalos costalis (Cresson). In *A. discolor* and *A. senatoria* from Walker Co., Texas. This insect superficially resembles a yellowjacket (*Vespula maculifrons* (Buysson)). It occurs solitarily and is probably a hyperparasite on tachinid parasites in *Anisota*. Trigonalids represent a small and poorly known family.

Ichneumonidae

Hyposoter fugitivus (Say). In *A. peigleri* from Greenville and Clemson, South Carolina; in *A. pellucida* from Anderson Co., S. C.; Baton Rouge, Louisiana and Saint Francis Co., Arkansas; in *A. discolor* from Giddings, Texas; in *A. senatoria* from Walker Co., Texas; in *A. consularis* from Statesboro, Georgia; in *A. fuscosa* from Brazos and Walker counties, Texas. In *A. finlaysoni* from Shannonville, Ontario (leg. L. R. Finlayson, in alcohol in Royal Ontario Museum). The species is reported by Muesebeck *et al.* (1951) to attack *A. stigma, A. virginiensis, A. senatoria* and numerous other hosts in Saturniidae and other lepidopterous families. In *Anisota* very young larvae are attacked. In the second or third instar the host dies and its dried skin is fastened to a leaf or stem by the parasite larva within which it spins its cocoon within the host (figured by Felt, 1930). In Baton Rouge we found the incidence of parasitism to be extremely high and encountered no hyperparasitism.

The following species of Ichneumonidae are hyperparasites of *H. fugitivus: Gelis tenellus* (Say) in *A. peigleri* from Hendersonville, North Carolina; *Lymeon orbus* (Say) in *A. fuscosa* from Walker Co., Texas; *Isdromas lycaenae* (Howard) in *A. peigleri* from Hendersonville, N.C. The last species closely resembles its host, *H. fugitivus*, but is smaller. The material from North Carolina was given us by David Montross, entomologist at Clemson University.

Braconidae

Apanteles anisotae Muesebeck. In *A. discolor, A. fuscosa,* and *A. senatoria* from Walker Co., Texas and *A. fuscosa* from Brazos Co., Texas. These small black wasps affect larvae in any instar. When mature, the parasitic larvae emerge and spin light yellow cocoons on the surface of the host. Larger hosts support more parasites but the number rarely exceeds ten.

Chalcidae

Ceratosmicra meteori Burks. This yellow wasp is a solitary hyperparasite of *H. fugitivus* in *A. fuscosa* from Brazos and Walker counties, Texas and in *A. peigleri* from Clemson and Seneca, South Carolina and Hendersonville, North Carolina. R. T. Mitchell has taken both this species and *Spilochalcis albifrons* (Walsh) as hyperparasites of *H. fugitivus* in *A. senatoria* at Patuxent Wildlife Research Center at Laurel, Maryland.

Eupelmidae

Anastatus reduvii (Howard) (possibly a synonym of *A. semiflavidus* Gahan). In *A. pellucida* and *A. consularis* from White Springs, Florida; in *A. consularis* from Statesboro, Georgia; and in *A. fuscosa, A. discolor,* and *A. senatoria* from Walker Co., Texas. These tiny wasps are ovarian parasites; usually less than half the eggs of an egg mass is attacked. The parasites emerge from the host eggs several days after the larvae of *Anisota* eclose from the adjacent unaffected ova. This is because the parasites must develop through a larval and pupal stage within the host egg. There is only one parasite per host egg. Beal (1952) reported a species of *Anastatus* in *A. senatoria [A. peigleri* ?] in North Carolina. The wasps also attack ova (the overwintering stage) of saturniids in the genus *Hemileuca* (Watts & Everett, 1976).

Eulophidae

Horismenus floridanus (Ashmead). This is a solitary hyperparasite in *Apanteles anisotae* from Walker Co., Texas. It emerges from the side of the cocoon, whereas adults of *Apanteles* exit from the end of their cocoon. The females of *H. floridanus* oviposit in the larva of *Anisota*, this being clear because the hyperparasites emerged from *Apanteles* which had emerged from their host and pupated in the lab (unexposed).

Tetrastichus sp. or spp. In *Anisota* from Walker Co., Texas and in *A. peigleri* from Greenville, South Carolina. The minute wasps are egg parasites much like *A. reduvii*. They can be stramineous or black but this color difference may be sexual rather than taxonomic. Hitchcock (1961b) records these parasites from *A. senatoria* in Connecticut.

Perilampidae

Perilampus carolinensis Smulyan. In *A. senatoria* from Laurel, Maryland (R. T. Mitchell). This larval parasite is metallic blue and about 4 mm long. Apparently is a solitary endoparasite killing half-grown larvae.

Most parasites attacking *Anisota* are not host-specific to the genus. Many have geographical distributions wider than the individual species of *Anisota*, thus attacking the different host species in different parts of their (the parasites') range. Some species of *Cratichneumon* (Ichneumonidae) are also recorded as parasites in *Anisota* (Hitchcock, 1961c; Heinrich, 1977). Voucher specimens for most of our above records are in the USNM and other museums.

John Abbot

An early pioneer naturalist and artist of Georgia was John Abbot (1751-1840?) who sent countless specimens and paintings of these to European museums and collectors. Excellent biographical treatments are given by Coulbourn (1973) and Harris (1972); the latter also provides a bibliography on sources about Abbot's life.

Before leaving England at the age of 22, Abbot had made the acquaintance of the entomologist Mr. Dru Drury. After settling in Georgia in 1776 Abbot sent many life-sized colored illustrations of insects to such persons as Dr. J. A. Boisduval of Paris and Dr. James Edward Smith of England. Two species of *Anisota* were figured as new in the book by Smith: *The Rarer Lepidopterous Insects of Georgia* published in 1797. Smith used some of Abbot's drawings in his book with appropriate credit to the artist, and this is why the authorship of many Lepidoptera (including *A. senatoria* and *A. pellucida*) is sometimes seen in the literature as "Abbot & Smith".

Although Abbot lived in Georgia in Burke County (a part of which later became Screven County) and also in Bulloch County, we cannot do more than *assume* type localities for taxa described and figured in Smith's book. There is even the possibility that some specimens Abbot used as models for his paintings originated from areas outside of Georgia.

Other taxonomic problems created by this book include the fact that some plates contain larvae of one species mixed with adults of related species (Riotte, 1972: 11 and Ferguson, 1978: 82), and the fact that the drawings, however elegant, must be interpreted as diagramatic at best and should not be given the favor that systematists would afford color photographs. Colors on the plates differ from copy to copy which was a main reason for creation of the synonymy of *A. virginiensis sinulis*, the material not agreeing with some figures of *A. pellucida*. Also the copy of Smith's book in the Carnegie Museum library has very light-colored figures of "*Phalaena stigma*" so that we were at first certain they represented *A. consularis* (larva, male, and female). Later we decided they probably indeed represent *A. stigma* upon viewing the differently colored plates in the copy at the CNC in Ottawa. Comments on the correct interpretation of Abbot's plate of "*Phalaena senatoria*" are given under our text of that species. We have attempted to overcome these taxonomic difficulties by consulting the original plates for the book in the BMNH and designation of neotypes of the concerned taxa.

Treatment of the Species

MEXICAN GROUP

Anisota assimilis (Druce)

Dryocampa assimilis Druce, 1886: 170, pl. 15, fig. 5.

Anisota assimilis; Bouvier, 1931: 22; Schuessler, 1936: 212; Draudt, 1930: 814; Hoffman, 1942: 245; Ferguson, 1971: 64; Lemaire, 1976: 47.

Anisota leucostygma (not Boisduval, 1872); Draudt, 1930: pl. 142f; Bouvier, 1931: 18 (*partim*); Hoffman, 1942: 245. [Error in determination.]

ADULT

Male (pl. IV, fig. 11): Head, thorax, legs, abdomen reddish brown; fore- and hindwings uniformly reddish brown, more brown on forewing, hindwing more reddish; postmedian line only very slightly marked on both wings on upperside, a little more pronounced on underside; white discal spot small. Underside of wings colored as upperside but lighter. Outer margin slightly rounded in forewing and more so in hindwing. Length of forewing 21-23 mm (4 specimens measured).

Female (pl. IV, fig. 12): Described here for the first time. Head, thorax, abdomen, legs, fore- and hindwings on upper and underside all almost uniformly lighter or darker fawn colored, with a pinkish tinge on the hindwings; less intensely colored outside postmedian line; no dark scales on wings; postmedian line barely

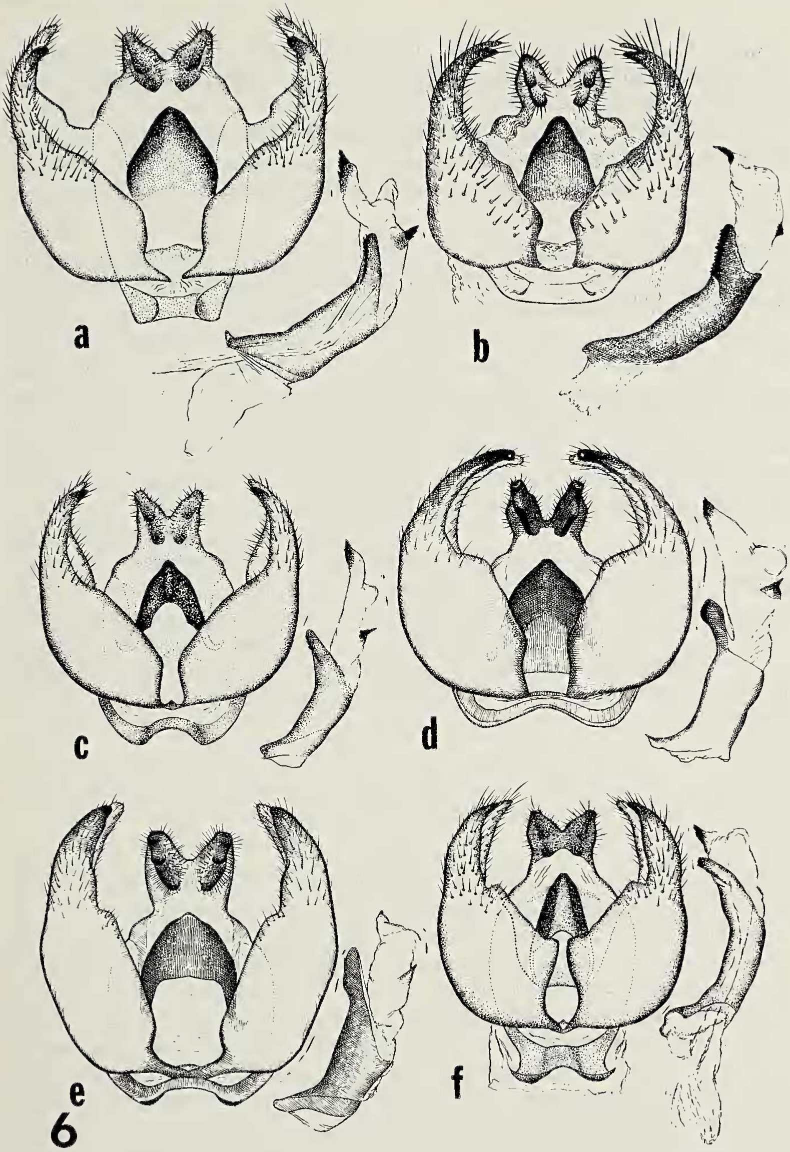

Fig. 6. Male genitalia, with aedoeagus removed and alongside: a. *A. stigma*, b. *A. fuscosa*, c. *A. consularis*, d. *A. manitobensis*, e. *A. oslari*, f. *A. assimilis*.

perceptible; a little more conspicuous on underside; white discal spot larger than in male. Outer margins as in male. Length of forewing 30-35 mm (3 specimens measured).

Head: Laterofrontal suture visible. Frontal protuberance transverse, not prominent. Male antenna with 18 rami. Posterior aspect of head not investigated because of rarity of specimens.

Legs: Male epiphysis slender, a little longer than half the length of the tibia, densely covered with very short hairs, a few long ones laterally and at apex; empodium as usual, with one moderately long seta; epiphysis in female not found.

GENITALIA

Male (fig. 6f): Uncus M-shaped, apices heavily chitinized and broadly triangular; gnathos narrowly triangular; valves uneven interiorly, more straight than rounded, ventral part of bifurcation pointed and strongly chitinized; dorsal part of equal length but much wider and blunter than the ventral pointed end; free anellus heart-shaped with broadly rounded apices; saccus very much elongated cephalad into two spoon-shaped structures which are joined together by a bridge. Aedoeagus larger than in other groups, curved, but not as much as in *A. virginiensis* although very similar; carina as in *A. virginiensis*, but teeth a bit larger; vesica with one well-developed cornutus at the end and a much reduced one in the middle; cephalic margin of proximal end angular (ROM gen. prep. 3-034).

Female (fig. 8i): Ovipositor valves of a peculiar shape, much wider at the base than at the apex, apex not rounded but linear; lobuli vaginales high; sterigma of medium height; antrum showing marked relation to *A. virginiensis*, appearing in lateral view as an oversized oval connection between ostium bursae and bursa copulatrix which is connected by a very short ductus bursae; ostium bursae strongly circumscribed; ductus seminalis connected laterally in first quarter of antrum; bursa copulatrix round; signum, if present, very small, round (ROM gen. prep. 3-084).

EGG

Yellow when deposited, becoming various shades of brown through development. Length 1.7 mm, width 1.5 mm, height 1 mm.

LARVA (pl. I, fig. 7)

The following description is based on material from R. O. Kendall. Data on earlier instars are too inadequate and fragmentary to give at the present time.

Fifth instar: Body, headcapsule, and anal plate beige brown; horns on second thoracic segment smooth with only a few short, thin setae, only slightly clubbed, 5 mm long; on each segment a black saddle from spiracle to spiracle, the width of a segment, sometimes so much expanded that only fragments of the beige brown body color are visible between; on the saddle a pattern of porcelain white smaller and larger ecrescences, the latter with a small seta at the end of each; a subdorsal, supraspiracular and subspiracular row of white thorns with a small seta on top, in some spcimens stronger and more or less blackened; spiracles black; an extended black ring around the outer half of the legs or prolegs, a similar patch on segments without prolegs, with small and medium white ecrescences, the latter ones with a small seta at the end of each; a thin dorsal line; a light beige ventral one; the eighth segment with one subdorso-lateral more prominent thorn on each side; on the ninth segment a dorsal one; length 43 to 47 mm.

PUPA (pl. VII, fig. 10)

Dark reddish brown; 25 mm long; stout; cremaster very short; evenly protruding; similar to *A. oslari* but with a wider base.

DISTRIBUTION

From the figures in Draudt (1930) (see discussion below) we have the record of Tamaulipas. Numerous other widespread records show the species to occur from Mexican states bordering the United States south to Chiapas. Since the latter locality (Comitan) is only ca. 50 km from the Guatemala border, the species is probably also present in that country.

TYPE MATERIAL

The male holotype was collected in Santa Ana, Chihuahua, Mexico by Buchan-Hepburn according to the original description. This specimen was examined by the junior author at the BMNH. The type locality remains unclear because at least five places in Chihuahua are named Santa Ana.

BIOLOGY AND REMARKS

According to Draudt (1930) a paper by A. Dampf was to be published describing the immature stages, but this paper could not be located and presumably was never published. Although Draudt treated Dampf's material as *A. leucostygma*, the color figures (pl. 142f) leave no doubt that the species was actually *A. assimilis*. The Dampf material in Draudt's collection was destroyed in World War II (Franz Daniel, Zool. Samml. Bayerisch. Staates, *in litt.*).

Although Ferguson (1971: 64) remarked that this species is known only from the unique male type, we found numerous specimens available for study as listed under material examined. Inadequate series are available however to clarify apparent differences between northern and southern populations. A series from Chihuahua reared from larvae collected on *Quercus grisea* by Roy and Connie Kendall agrees well with the holotype, as does the male seen from Durango. Specimens from other localities are larger with less intensely marked postmedian lines in the males, and there exists more variation among the series from Chihuahua. The latter also exhibit more gray clouding in the wings.

The nearly mature larvae collected by the Kendalls were found in late September and adults emerged the following summer. Adults from Oaxaca were taken in September, from Chiapas in June, from San Luis Potosi in April and from Veracruz in July. Apparently these scant data suggest the species is univoltine in the northern part of its range and bivoltine in the southern part. The immature stages are herein described and figured for the first time.

MATERIAL EXAMINED

MEXICO. CHIAPAS: Comitan (Lemaire Coll., Peigler Coll., ROM, all *ex* Lemaire Coll.). CHIHUAHUA: Santa Ana (BMNH); near Creel, 2200 m (Kendall Coll., Lemaire Coll., Peigler Coll., all *ex* Kendall Coll.). DURANGO: near Durango City (BMNH). OAXACA: no additional locality data (Lemaire Coll.). SAN LUIS POTOSI: Posada El Sol, Tamazunchale (IBM), Tamazunchale (AMNH, UCal). VERACRUZ: Poza Rica (UCal). Examined 20+ males, 30+ females; dissected 3 males, 1 female.

Anisota dissimilis (Boisduval)

Adelocephala dissimilis Boisduval, 1872: 93.

Dryocampa dissimilis; Druce, 1886: 170, pl. 15; Kirby, 1892: 740.

Anisota dissimilis; Packard, 1905: 116; Bouvier, 1927: 273; ibid., 1931: 21; Schuessler, 1936: 212; Draudt, 1930: 814, pl. 142g; Hoffmann, 1942: 245;

Ferguson, 1971: 64; Lemaire, 1976: 48.

Anisota suprema Henry Edwards, 1884: 16; Schaus, 1884: 102 (larva); Druce 1897: 415; Packard, 1905: 115, pl. 19, figs. 7, 7a; Bouvier, 1927: 273; Schuessler, 1936: 218; synonymized by Draudt, 1930: 814; type locality: Jalapa, Veracruz, Mexico.

ADULT

Male (pl. III, fig. 10): Head and thorax mahogany brown; abdomen blackish brown; legs blackish; basal area of forewings and posterior tuft of abdomen mahogany brown; terminal area with purplish overtone; venation on forewings blackish; hindwings dark blackish brown; postmedian line blackish, well-marked on forewings only; white discal spot medium sized; underside of all four wings alike, with reddish mahogany basal areas, terminal area with purplish overtone; postmedian line and venation well-pronounced and blackish on all wings. Outer margin of forewings slightly rounded, of hindwings rounded. Length of forewing 22-27 mm (12 measured). In some specimens the hindwings are not as deeply colored as usual; in these the venation shows up in the normal darker coloration.

Female (pl. III, fig. 11): Much lighter colored; head and thorax ochreous brown; abdomen blackish brown, the segments outlined in ochreous brown; legs blackish; forewings leathery brown, or orange to yellowish brown; hindwings suffused slightly with color of male hindwings in much diluted form or with a pinkish hue; venation on forewings reddish brown, on hindwings blackish; postmedian line well-marked on all wings, blackish; white discal spot larger than in male; underside of both wings with basal area rosy brown, terminal area like hindwings above, postmedian lines broad and blackish. Outer margin as in male. Length of forewing 32-37 mm (23 measured).

Head: Laterofrontal suture strongly visible. Frontal protuberance transverse, insignificant. Male antenna with 18 rami. Posterior aspect of head showing well-developed short triangular lateral projections, apex straight.

Legs: Epiphysis found only in male, very thin, length ¾ that of tibia, rod-shaped, covered with extremely short hairs at apex, with some long ones marginally.

GENITALIA

Male (fig. 10a): Uncus distinctly M-shaped, straight laterally, two separate sclerotized elevations on each arm; gnathos broad, triangular shield with straight lateral sides cephalad; valves of the usual form with specific peculiarities, ventral part of bifurcation a sharp, heavily chitinized thorn, dorsal one a bit longer, much wider; free anellus a wide evenly-shaped heart crescent with very short apices. Aedoeagus only weakly chitinized, straight and short, carina without cornuti; vesica also short but with cornuti, one in middle, the other minutely serrate and at the apex. (Gen. prep. no. 349 Michener, AMNH).

Female (fig. 10b): Ovipositor valves rounded at apex; lobuli vaginales very low, sterigma as usual; antrum short, ending in an irregular triangular shape; ductus bursae bent abruptly laterad at half length, then again cephalad where oblong bursa copulatrix is attached; no signum; ductus seminalis connected at beginning of antrum, ventro-medially (unusual). (Gen. prep. no. 350 Michener, AMNH).

EGG

Unknown to us.

LARVA

No specimens were available for the present study, nor do any illustrations exist. The following description is summarized from Schaus (1884). Length ca. 60 mm; head, mesothoracic segment and anal segment yellow; other segments black dorsally, the metathoracic one having a yellowish subdorsal line; mesothoracic segment also mrked with four small black spots dorsally and one laterally. Beginning on the metathoracic segment four dorsal rows and one lateral row of short pointed black spines occur. The two inner dorsal spines on the metathoracic segment are, on the contrary, long and blunt at the tips; small patches of white spots on thoracic segments; color of first three abdominal segments yellow, the following ones reddish brown; black spots between abdominal segments; prolegs yellowish; abdominal segments 2, 3, and 4 yellow ventrally, the succeeding ones having a yellow line; "centrally and exteriorly a large black spot". Anal segment covered with spiny ecrescences. Young larvae differ in being greenish black dorsally and without the patches of white spots.

PUPA (pl. VII, fig. 11)

Two dried pupae were available for study. End of pupa gradually tapering; cremaster long, bifurcated; bifurcation short and strong; on both sides of thorax a patch of very heavy sclerotization with irregularly arranged pits; form of patch and arrangement of holes seem to be specific but more pupae should be studied.

DISTRIBUTION

Aside from the records given below under material we examined, there is the additional one of Guatemala (Bouvier, 1931: 21) and the remarks of Hoffmann (1942): "Tierras fria y templada de Veracruz, Montanas de Hidalgo, Puebla y Oaxaca. Sierra Volcanica Transversal. Guanajuato. Durango."

TYPE MATERIAL

Type locality: Oaxaca, Mexico (not specified as to Oaxaca State or Oaxaca City).

We have seen the pair of cotypes from the Boisduval collection in the MNHN in Paris. We herein designate the male as lectotype and the female paralectotype.

The holotype male of *A. suprema* we have seen in the AMNH.

BIOLOGY AND REMARKS

The food was reported to be oak (Schaus, 1884). The insect is widespread in central and southern Mexico at moderate to high elevations and probably extends into Guatemala. It is said to be abundant at Jalapa (Packard, 1905), but the junior author failed to find it there on a brief trip through that area.

It is not possible to say much about the flight times since the few records are widely scattered geographically. Records for Chiapas of March, May, June, and July suggest two broods. Also it has been taken in Chimalapa in September, in Jalapa in May, and in Zacualpan in June. The species is probably not sympatric with its ally to the north, *A. punctata*.

A male from Jalapa (pl. III, fig. 12) in the MHNM from the Roberto Mueller collection is unusually suffused with black. It appears more normal underneath. Good colored figures of both sexes are given by Packard (1905), Druce (1886), and Draudt (1930).

As we stated under "Intrageneric Classification and Phylogeny" this species appears to be the most primitive species in the genus, the geographical distribution supporting this idea.

The abdomen has a blackish coloring of scales but the intersegmental membranes are bright orange. Several saturniids in the Hemileucinae (e.g., *Dirphia, Molippa,* etc.) show this warning coloration of orange and dark stripes, curling the abdomen when disturbed to expose the orange.

MATERIAL EXAMINED

MEXICO. CHIAPAS: Rancho San Ramon near Mun Ochuc (= Oxchuc) (LACM, Lemaire Coll., Peigler Coll.). DURANGO: Chilpancingo Palos Colorados (AMNH). DISTRITO FEDERAL: Mexico City (AMNH). HIDALGO: Zacualpan (AMNH, ROM). OAXACA: (AMNH, ROM, MNHN), Chimalapa (Lemaire Coll.). PUEBLA: "Manzanilla" (AMNH), Coatepec (USNM). VERACRUZ: Jalapa (= Xalapa) (AMNH, MHNM), Mirador (ranch of R. Mueller near Cordoba) (MHNM), Orizaba (USNM). Examined 15 males, 27 females, used pair of dissections of Michener (AMNH).

Anisota oslari W. Rothschild

Anisota oslari Rothschild, 1907: 432; Jordan, 1908: pl. 10: 13; Bouvier, 1931: 19; Schuessler, 1936: 212; Draudt, 1930: 814; Hoffmann, 1942: 245; Ferguson, 1971: 78; Lemaire, 1976: 47.

Anisota skinneri Biederman, 1908: 77; Barnes and McDunnough, 1910: 400 (biology); - synonymized: Barnes and McDunnough, 1917: 28; type locality: "Arizona".

Anisota neomexicana Brehme, 1909: 324; synonymized: Barnes and McDunnough, 1917: 28; type locality: Fort Wingate, New Mexico.

ADULT

Male (pl. IV, fig. 9): Head, thorax, abdomen orange-ochreous; legs wine-red; forewings dark reddish mahogany; no hyaline patch; hindwings deep wine-red; postmedian line very slightly marked; white discal spot variable in size; forewings triangular with an acute apex; underside of both wings wine-red, darker in forewing basal area; lighter apically. Outer margin of both wings usually rather straight. Length of forewing 23-29 mm (12 specimens measured).

Female (pl. IV, fig. 10): Head, thorax, abdomen, legs light ochreous brown; forewings beige; hindwings light wine with mauve tinge; postmedian line broad and slate colored; white discal spot variable in size; underside of wings beige with mauve tinge, basal area of forewings with light wine-red shading. Outer margin of wings rounded. Length of forewing 30-41 mm (11 specimens measured).

Head: Laterofrontal suture visible. Frontal protuberance transverse, not prominent but somewhat more produced than in the other species of the group. Male antenna with 19 rami. Posterior aspect of head shows a scalloped outline; one well developed lateral process together with one large rounded process differentiates *A. oslari* from all other species of the genus.

Legs: Epiphysis slender, half as long as tibia, densely covered with very short hairs, laterally and at apex a few longer ones; observed only in the male. Empodium with one tubercle bearing a medium-sized seta.

GENITALIA

Male (fig. 6a): Uncus quite broadly M-shaped, apices heavily sclerotized; gnathos broad with rounded apex, margins somewhat sinuate; midsection of lateral margin of valves curved, upper and lower sections straight; parts of bifurcation of unequal length, dorsal part not chitinized, much wider than ventral ones; free annellus a heart shaped crescent. Aedoeagus very short, straight, carina with a small tooth on ventral edge; vesica with one well-developed cornutus at mid-length; the usually strong cornutus at apex rudimentary, a very slight chitinization of edges of triangular apex so that *A. oslari* has only one real cornutus on vesica. (Gen. prep. ROM 3-032).

Female (fig. 8h): Ovipositor valves broadly rounded, whole structure large, "angular"; lobuli vaginales as in *A. finlaysoni*; sterigma more straight; antrum absent; ductus bursae not chitinized, making an abrupt 90° turn laterally where bursa connected; ductus seminalis connected in upper fifth of ductus bursae laterally. (Gen. prep. ROM 3-038).

EGG

Smooth, flatly elliptical, pale yellow, 2 mm by 1.8 mm by 1.2 mm; hatching after about 14 days.

LARVA (pl. I, fig. 8)

The following is taken from Barnes and McDunnough (1910):

First instar: Body at hatching yellowish, later greenish-grey, legs black. Length 3 mm.

Second instar: Head red, body olive brown, turning later red-brown; skin granulated; all tubercles and spines shiny black. Horns on second thoracic segment 2.3 mm long, covered with minute bristles, apex slightly bifurcate. Spiracles black, legs black. Length 9 mm.

Third instar: Head orange-red with fine network of darker lines, sparsely covered with very minute setae. Body brick-red. Skin granulated with a well developed lateral fold. Horns on second thoracic segment slightly recurved, 5.5 mm long. Spiracles black; legs black. Length 19 mm.

Fourth instar: Head and body as in previous instar. Mesothoracic horns 8 mm. Spiracles, prolegs black. Length 38-50 mm, presumably according to the sex.

Fifth instar: Head reddish-brown, shiny; body dark brick-red, very strongly granulated, with broken yellow subdorsal and spiracular stripes, the latter being chiefly confined to a yellow patch about spiracle. Horns on mesothorax only 5.5 mm. Spiracles black; legs pale red. Length 50-65 mm. Material in alcohol from Texas received from R. O. Kendall and from Arizona received from E. M. Brown was used to verify this description. Headcapsule shown in fig. 4e, suranal plate in fig. 2e.

PUPA (pl. VIII, fig. 3)

Material from Texas and from Arizona was available for study. Dark brown; posterior end gradually narrowing, margins proceeding smoothly from segment to segment; cremaster long, bifurcated; parts of bifurcation thin and longer than in *A. dissimilis*; the patches on the mesothorax have a different form and pattern of shallow pits than in *A. dissimilis*.

DISTRIBUTION

The species is known from southeastern Arizona, New Mexico, west Texas and Sonora. In fact it seems that *A. oslari*, as so many other Lepidoptera found in Arizona, New Mexico and Texas, has its origin in Mexico. Ferguson (1971) says that Texas specimens were of a more recent date, however, in AMNH there is a female specimen from Sunny Glen Ranch, 1500 m, Brewster Co., Texas, collected on 10 June 1926. In the same collection is also a male and a female with the label

"Janeiro" and no other data from the Frank Johnson collection. This locality could not be identified.

TYPE MATERIAL

Type locality: Nogales, Santa Cruz County, Arizona. Additional type data: described from 2 females obtained by E. J. Oslar in July 1903 "from chrysalids dug from the roots of the century or mescal plant". Location of cotypes: British Museum (Nat. Hist.). We hereby designate one female (dated 10 July 1903) as lectotype and the other as paralectotype; these specimens were examined by the junior author.

For *A. skinneri* a lectotype was designated by Ferguson (1971); it is the specimen which was labelled as the male type in USNM.

For *A. neomexicana* a lectotype was selected with F. H. Rindge from among the cotypes in AMNH and is hereby designated: male, New Mexico, 28 June, no year, *ex* coll. J. A. Grossbeck.

BIOLOGY AND REMARKS

Ferguson (1971: 79) suggested that *A. oslari* might be a junior synonym of *A. assimilis* but the true identity of the latter species was uncertain to him. Ample material of *A. assimilis* is now available to clarify this uncertainty.

Earll M. Brown of San Diego has reared larvae of *A. oslari* from Arizona on *Quercus kelloggii* in California. According to Biederman (1908) the food is "black (live) oak", but we are unsure which oak species was meant. Larvae can probably be collected on most oaks where the moth occurs. As far as we know, our figure of the larva is the first one to be published.

The males are diurnal, flying during midday. Although they lack transparent patches on the forewings, they are undoubtedly effective mimics of wasps with their rapid flight and reddish orange coloration. The females are nocturnal and attracted to light. There is one generation annually, with adults flying in late summer or early fall, and larvae found in late fall. Reared material may emerge in early summer.

The males show several color forms from light mauve (as in females) to dark wine (as figured) and dark slate gray. Usually, the forewings and hindwings differ slightly in color, in both sexes. The color forms coincide to those of *A. assimilis*. The male and female figured by Ferguson (1971: pl. 5, figs. 25, 26) are very typical representatives for the species.

MATERIAL EXAMINED

MEXICO. SONORA: not seen, reported by Hoffmann, 1942. UNITED STATES. ARIZONA: no other data (AMNH, CalAcSci); Garces (CM); Madera Canyon, Santa Rita Mountains (LACM); Nogales (CalAcSci, LACM); Palmerlee (CM); Pena Blanca Lake, Santa Cruz County (BPBM, Peigler Coll., ROM); Sonoita Creek, Santa Cruz County, S. of Patagonia (LACM); Sunnyside, Huachuca Mountains (LACM); Texas Canyon, Chiricahua Mountains (CNC). NEW MEXICO: no other data (AMNH, CalAcSci, FMNH, ROM); Fort Wingate (AMNH, CM, CNC, FMNH, LACM, USNM); Frijoles Canyon (AMNH); Jenny Springs (CM); Jimez Springs (CNC). TEXAS: Fort Davis (USNM); Musquiz Canyon, Jeff Davis County (ROM); Nickel Creek, Guadelupe Mountains (USNM); Sunny Glen Ranch (AMNH). Examined 58 males, 64 females, dissected 1 male and 2 females.

Anisota punctata *Riotte & Peigler,* **New Species**

Anisota punctata Riotte & Peigler, 1980: on this page.

ADULT

Male: unknown. It is expected that the male is nocturnal and resembles the male of *A. dissimilis* somewhat in appearance, but with many small dark spots on all wings.

Female (pl. III, figs. 8-9): Head, thorax, abdomen below ochreous brown, legs with a purplish hue; abdomen above with an olive hue; forewings leathery brown with numerous large spots of dark scales; hindwings purplish pink with some dark scales and a slight marginal border of leathery brown; postmedian line straight, very well perceptible on both wings, dark mauve; white discal spot very large; underside of wings rosy brown with strong sprinkling of black spots, especially apically on forewing and entire hindwings. Outer margin of forewings straight, of hindwings only slightly rounded. Length of forewing 37 mm. Specimen not dissected because it is unique.

EGG, LARVA, PUPA

Unknown.

DISTRIBUTION

Known only from the type locality but probably occurring in other northern Mexican states at appropriate elevations in the same mountain range.

TYPE MATERIAL

Type locality: 27 km west of Linares, Nuevo Leon, Mexico. Known only from the single holotype female collected at this locality on 23 July 1976 at 2100 hrs by R. S. Peigler. The holotype is deposited in the AMNH in New York City.

BIOLOGY AND REMARKS

The holotype was collected on a trip into Mexico sponsored by the Entomology Department of Texas A&M University, of which the junior author was a member. On 23 July 1976 an ultraviolet light in conjunction with a Coleman lantern was run on a sheet and the moth arrived at this light source two hours after sunset. No other specimens of *Anisota* were collected on the entire trip. The female was kept alive in a jar with oak leaves but died the following evening, unfortunately without depositing any ova.

The following summer the junior author returned to the same locality and ran the same lights for three consecutive nights (22-24 July 1977) but no additional specimens were obtained. That season had been unusually dry; a stream alongside the collecting site was dry, whereas it had been flowing in July 1976. Several species of Saturniidae and Sphingidae taken there in 1976 were not seen in 1977. The habitat of the type locality is forested. It lies in the foothills of the Sierra Madre Oriental. Pressed specimens of the oaks growing at the type locality were sent to John M. Tucker, Department of Botany, University of California, Davis, California. Dr. Tucker, an authority on New World oaks, made the following determinations:

Note Added in press: The LACM has a female of this new species, apparently recently donated, which is said to agree entirely with our figures of the holotype. The data for the specimen are: MEXICO, San Luis Potosi, El Narzanjo, 4 August 1975, Terry W. Taylor. There is not time to borrow the specimen and designate it a paratype before publication.

Quercus canbyi Trel., *Q. fusiformis* Small, *Q. polymorpha* Schl. & Cham. The first species has a high density in the area and with its large, tender, non-pubescent leaves, may be the primary host of *A. punctata.*

PELLUCIDA GROUP

Anisota discolor *Ferguson* **New Status**

Anisota virginiensis discolor Ferguson, 1971: 83; Lemaire, 1976: 47.

ADULT

Male (pl. IV, fig. 6): Sexual dimorphism strongly developed. Head, abdomen, fore- and hindwings above sepia brown with a very slight purplish hue apically on the forewings; head, abdomen, legs, fore- and hindwings beneath predominantly of a greenish brass color, however, on the forewings apically and on the hindwings along the postmedian line and from wingbase to tornus purplish shades, on the forewings the veins are conspicuously overlaid by the greenish brass color; sprinkling with dark scales not observed in this species of the group; postmedian line on the forewings well, on the hindwings only slightly perceptible; hyaline patch not very extended; white discal spot medium sized; outer margin of forewings rounded, of hindwings almost straight. Length of forewing 18 mm (10 specimens measured).

Female (pl. IV, fig. 5): Head, abdomen, fore- and hindwings above almost unicolorous fawn with only very slightly purplish apically (fresh specimens tend to have a greenish shade over the entire wings); head, abdomen and legs beneath orange; fore- and hindwings beneath basically light purplish, strongly overlaid with greenish, ochreous orange; postmedian lines on both wings, above and beneath, well marked, purplish; white discal spot medium sized; only very few and very small dark scales on the forewings above costally; outer margin of forewings slightly, of hindwings strongly rounded. Length of forewing 27 mm (10 specimens measured).

Head: Laterofrontal suture very conspicuous, wide; frontal protuberance well developed and protruding. Male antenna with 14 to 15 rami. Posterior aspect of head pentagonal, laterally one conspicuous, round process.

Legs: Epiphysis dorsally strongly convex, ventrally straight, ending in point, covered with very short bristles, length little more than half of tibia. Epiphysis may be different in one and the same specimen on left and right leg, dorsally and ventrally straight and of even width, ending in blunt ending, length a little less than half of tibia; in some specimens epiphysis may be rudimentary, very thin, hardly half length of tibia; not observed in female; empodium one tubercle with slender thin seta; at end of anterior tibia spines normally developed, i.e., one strong one and one lesser.

GENITALIA

Male (fig. 7f): Squarish; uncus wide M; gnathos sometimes with waving sides. Mostly a very broad round shield; bifurcations of equal length; interior angle of valve pointedly elongated; free annellus long, round tube with somewhat heart-formed opening; aedoeagus rounded, more narrow than in *A. virginiensis* but a little wider than in *A. pellucida*; proximal end straight; carina prolongation of main body of aedoeagus; row of small teeth on carina; vesica with very prominent apical cornutus with teethed edge; there was no small, rudimentary second sclerite in 6 dissected males from Texas, however, such sclerite was often found in specimens of

A. virginiensis from Pennsylvania. (Gen. prep. ROM 3-164).

Female (fig. 9d): Ovipositor valves tapering off apically, of unusual form; lobuli postvaginales high, antevaginales very low; antrum like strong triangular funnel, connecting ostium bursae and strong, short, slightly oblique ductus bursae which has in its first third laterally strongly sclerotized ecrescenses; ductus seminalis attached at beginning of ductus bursae posterior-laterally; bursa copulatrix very slightly bent off ductus bursae, rounded oval, no signum, covered with fine network. (Gen. prep. ROM 3-051).

EGG (The following descriptions of egg and larvae—first to fourth instar—by C. Lemaire).

Yellow changing into orange and brown.

LARVA (pl. I. fig. 12)

First instar: Body color yellowish green, slightly blackish; very near to second instar of *A. senatoria*; headcapsule and thoracic legs black.

Second instar: Body color dingy greenish-yellowish; headcapsule and thoracic legs black.

Third instar: Body color dark olive brown; headcapsule beige-brown; thoracic legs black; prolegs olive; subdorsal and supraspiracular lines rose brown; two very slight infraspiracular whitish lines.

Fourth instar: Body color blackish brown; headcapsule beige-brown; thoracic legs greenish with black apex; prolegs olive black; white granulation not dense over body; subdorsal and infraspiracular lines purplish brown.

Fifth instar: Body color beige-brown; headcapsule, anal plate, thoracic legs of same color; white granulation not too dense over body; dorsal line purplish brown; of same color also wider subdorsal, supraspiracular and subspiracular bands; a spiracular waved line of same color; spiracles black with no border; horns on thoracic segment II clubbed, 8 mm long; length of fifth instar larva 42 mm. Headcapsule shown in fig. 5f, suranal plate in fig. 3f.

PUPA (pl. VIII, fig. 2)

Blackish brown, similar to that of *A. virginiensis* but the bifurcation perceptibly straighter and longer, even more so than in *A. pellucida*.

DISTRIBUTION

This species was recently described from a series of specimens from several localities in eastern Texas. We now have records from Oklahoma (from P. Loy) and Louisiana (from R. O. Kendall); the species is probably only present in the western parts of Louisiana since we found it was replaced by *A. pellucida* at Choudrant and Baton Rouge. It is recorded in Texas as far northwest as Hamilton and as far southwest as Giddings. It is commoner than either *A. fuscosa* or *A. senatoria* in the grassland prairies between the Edwards Plateau and the forested areas of eastern Texas.

TYPE MATERIAL

Type locality: Spring, Harris County, Texas. Location of type: United States National Museum, type no. 71496. Additional type data: female holotype, labelled Spring, Harris County, Texas, 27 August 1963, A. and M. E. Blanchard.

BIOLOGY AND REMARKS

There are two generations per year but the main one is the later one. Many overwintering pupae probably do not produce adults until the flight time of the second brood. These flight times occur in late June to July and late August through all of September. Larvae can be collected easily in eastern Texas from late September to early November, some years more commonly found.

The male flies at midday. Their coloration is a smoky brown somewhat as males of *A. finlaysoni* but with more robust and thickly scaled wings. Some with the wine red coloring of *A. pellucida* occur occasionally. One male was attracted to a calling female in College Station, Texas, on 31 August 1978 at 1240 hrs (CDT). A diurnal sphingid (*Hemaris* sp.) also appeared but an attempt to capture it failed. This attraction was not surprising because Dominick (1974) had similar experiences with males of the sphingid *Amphion nessus* (Cramer) coming to females of *A. pellucida* in South Carolina.

In the females there is much more color variation than in either *A. pellucida* or *A. virginiensis*. Some are reddish or orangish as in those two species but most are "coffee-with-cream" colored. The postmedian area may be very purplish or scarcely contrasting from the median area.

Records for foodplants include *Quercus nigra* in Giddings, *Q. macrocarpa* in Hamilton, *Q. stellata* most often in College Station, and in eastern Texas usually the same oaks selected in the Atlantic States by other *Anisota*, namely *Q. velutina, Q. nigra,* and *Q. falcata* but also *Q. marilandica*. Although *Q. virginiana* grows commonly in College Station, no larvae of *Anisota* have been found on it by the junior author in three seasons.

MATERIAL EXAMINED

UNITED STATES. LOUISIANA: no other data (CalAcSci); Vernon Parish (Kendall Coll.). OKLAHOMA: Claremore, Rogers Co. (AMNH). TEXAS: no other data (AMNH); Anderson Co. (Larva) (TAMU); Beaumont (LACM, TAMU); College Station (AMNH, BPBM, LACM, Lemaire Coll., Peigler Coll., ROM, TAMU, USNM); Giddings (LACM); Hamilton (AMNH); Houston (USNM); Huntsville State Park (LACM); Karnack (MSU); New Waverly (USNM); San Jacinto Co. (LACM); Spring (USNM); Stubblefield Lake in Walker Co. (AMNH, BMNH, BPBM, CNC, Peigler Coll., ROM); Town Bluff (USNM). Examined long series of males and females, dissected 5 males and 4 females.

Anisota leucostygma Boisduval

Adelocephala leucostygma Boisduval, 1872: 85.

Adelocephala leucostigma; Druce, 1886: 171.

Anisota leucostygma; Bouvier, 1927: 273; ibid., 1931: 18; Draudt, 1930: 813; Hoffmann, 1942: 245; Ferguson, 1971: 64; Lemaire, 1976: 47.

ADULT

Male: unknown. It is expected to be diurnal.

Female (pl. IV, fig. 8): Head and thorax reddish orange; legs and abdomen lighter orange; forewings reddish orange interiorly of postmedian line, golden brown with a very light hue of slate color exteriorly of postmedian line; this line very well developed on both wings; white discal spot large (as name implies); hindwings reddish orange; only sprinkled slightly with dark scales on apical area of forewings; underside of wings reddish orange. Outer margin of both wings evenly rounded. Length of forewing 31 mm.

GENITALIA

Female (fig. 8g): Ovipositor valves not too large; sterigma very wide; lamellae postvaginales not too high; lamellae antevaginales laterally strongly expressed, not too high; ostium bursae not very wide, reaching into ductus bursae like hook (see illustration); antrum not too pronounced; ductus bursae caudally becoming very wide, narrowing considerably cephalad before bursa copulatrix which is round and attached without turn; signum small, round; surface of bursa copulatrix with net-like pattern; apophyses very strongly developed; ductus seminalis attaching at dorsal side of antrum. (Gen. prep. ROM 3-082, now in Paris Museum).

EGG, LARVA, PUPA

Unknown.

DISTRIBUTION

Boisduval (1872: 86) says: "Nous avons recu cette espece de Guatemala et d'Oaxaca". The specimen described above is the only one extant. It has no locality label, except Boisduval's first identification label stating only "Mexique".

TYPE MATERIAL

The one extant specimen passed through the collections of Charles Oberthuer and Philipon before becoming permanent property of the MNHN in Paris. Bouvier (1931: 18) declares: "D'apres Charles Oberthuer, la femelle de la collection Philipon est le type meme de *leucostygma*; elle porte l'etiquette suivante ecrite de la main de Boisduval: "*Adelocephala stygma*, Mexique." Dans sa description, en effet, Boisduval rapproche son espece de *stigma*." What Bouvier did we would call today the "designation of a lectotype", and with this the case may rest.

The labels on the specimen read: 1) handwriting of Boisduval: Adelocephala Stygma B Mexique; 2) handwriting of Oberthuer: Adelocephala Leucostygma, Boisduv. (Annal. Soc. Entom. Belgique, 1871-72, pages 85, 86, femelle, typicum specimen Boisduvalianum; 3) handwriting of Bouvier: Anisota leucostygma Boisd. femelle type + printed: E. L. Bouvier + handwritten: ver.(ified).

REMARKS

If there were not the unmistakable assertion of Oberthuer and the declaration of Bouvier for the identity of *A. leucostygma*, and if the genitalia of the unique specimen were not so impressively different from those of the three other species belonging to the same group, one could perhaps understand that entomologists are tempted to consider *A. leucostygma* as a mislabelled specimen from somewhere in the southern United States. However, one has to be very careful with unique specimens. *A. punctata* is a unique female from Mexico, too, and *A. assimilis* was until very recently a unique male from Mexico in the British Museum (N.H.). In the latter case various negative suppositions had been aired but finally the species was abundantly relocated in Chihuahua. This may very well happen to *A. leucostygma*. One should also consider the fact that the specimen has on the original Boisduval label as locality only "Mexique", and that at the time when the specimen came into the possession of Boisduval, about the middle of the 19th century, Mexico was still commonly understood by Europeans to extend much farther to the north than now and to cover all of Spanish speaking North America. We might disregard the locality designations in Boisduval's original description: Guatemala and Oaxaca. Also here political boundaries in those days were other than they are now. The southern states of today Mexico did belong to Guatemala. As far as then Oaxaca is concerned Boisduval may have been influenced by the locality from where he received his *Adelocephala dissimilis* (1871: 93), but one should not doubt his handwritten label

"Mexique" (sensu lato). One should here consider other cases of "unbelievable" species, like the Hawaiian hawkmoth *Tinostoma smaragditis* (Meyrick) which, because it just looked so strange, was green like *Eumorpha labruscae* from Brazil, was by later workers suspected not to be Hawaiian at all but was thought to have been sent in the mail from Brazil to Hawaii and then given to Perkins who, however, expressly says that he received the specimen from persons who had found it in their house on Kaua'i. Today, also very recently, several specimens of this indigenous insect are known and in collections. Therefore we should have some trust into the solid, early workers, and we can only hope that much better and subsequent collecting in Mexico will finally also turn up again *A. leucostygma*.

Specimens of *A. assimilis reared from Tamaulipas by Dampf were assumed by Draudt (1930) to be A. leucostygma* but his figures of Dampf's material (destroyed in war action) clearly show *A. assimilis.* Bouvier (1931) and Hoffmann (1942) therefore erroneously reported *A. leucostygma* as being from Tamaulipas.

In some of the literature it can be found that Boisduval considered his *A. leucostygma* to be systematically close to *A. stigma*. Maybe so, as his handwritten label suggests. However, his original description of *A. leucostygma* shows that he then changed his mind in the right direction.

Druce (1886) reports only briefly about the species which he has not seen from Mexico and Guatemala. Bouvier (1927) then does not mention "Guatemala" anymore.

MATERIAL EXAMINED

The one extant specimen of *A. leucostygma* was loaned to the senior author by P. E. C. Viette. It was then dissected and the genitalia show it to be very much distinct.

Anisota pellucida (J. E. Smith)

Phalaena pellucida J. E. Smith, 1797: II: 115, pl. 58; - synonymized: Westwood, 1837.

Dryocampa virginiensis; Westwood, 1837: 24, pl. 13: 2.

Dryocampa pellucida; Harris, 1841: 293.

Anisota pellucida; Grote, 1864: 93; Packard, 1864: 385; Lemaire, 1976: 47.

Adelocephala pellucida; Boisduval, 1872: 87.

Anisota virginiensis; Packard, 1905: 103.

Anisota virginiensis sinulis Riotte, 1970: 89; - synonymized: Ferguson, 1971; type locality: Gainesville, Florida.

Anisota virginiensis pellucida; Ferguson, 1971: 82.

ADULT

Male (pl. IV, fig. 3): Sexual dimorphism strongly developed. Head, abdomen above, fore- and hindwings above very dark brownish wine-red; legs, abdomen below dark orange; in many specimens apically sprinkled with dark scales; postmedian line well perceptible on both wings, also on underside; white discal spot small; an ochreous-brown hue can be found on hindwings, thorax and dorsal part of abdomen, it is, however, very often very faint. Underside of hindwings very dark, mostly only at anal angle of hindwings and at costal margin of forewings dark orange-ochreous suffused. Outer margin of both wings in most specimens straight, in some even showing some convexity; anal angle of hindwings only very slightly rounded. Length of forewing 14-16 mm (25 specimens measured).

Female (pl. IV, fig. 4): Densely scaled; interior field dark orange brown; exterior field mauve; head, thorax, abdomen dark orange brown; apically sprinkled with dark scales in many specimens; postmedian line strongly expressed; white discal spot not too large. Outer margin of both wings strongly rounded. Length of forewing 21-28 mm (25 specimens measured).

Head: Laterofrontal suture visible. Frontal protuberance reduced. Male antenna with 12 rami. Posterior aspect of head a smooth ellipsoid without lateral processes and in this quite distinct from other *Anisota* species.

Legs: Epiphysis observed only in males; light colored; slightly less than ½ of length of tibia; convex dorsally; straight laterally; ending in a point; only slightly covered with bristles. Empodium one small tubercle with one thin small seta. At end of anterior tibia only one strong apical spine, no second one.

GENITALIA

Male (fig. 5d): Uncus W-shaped, wide, apices strongly sclerotized; gnathos a narrow, oblong shield, reminding of a sugar loaf; valves from a very broad base narrowing into unusual long processes; outer margin of valves in the middle strongly bent which renders them hexagonal; interior angle of valve more or less pointed, in some specimens even elongated into a veritable thornlike process. Aedoeagus rounded, short, carina long and wide; at apex with a row of small teeth; vesica with one apical cornutus; proximal end narrow and pointed. (Gen. prep. ROM 3-099).

Female (fig. 9c): Ovipositor valves not too large, rounded at apex, in dorsal view broader at base, in lateral view very angular, with blackish pigmentation; sterigma wide; lamella postvaginalis low, lamella antevaginalis almost only like margin of ostium bursae; this very wide posteriorly, then narrowing into ductus bursae like funnel; antrum not too pronounced; ductus bursae only slightly sclerotized, cephalad of antrum straight to the left ending in oblong bursa copulatrix; no signum but surface of bursa copulatrix with fine net like pattern; apophyses long and relatively strong; ductus seminalis attaching on dorsal side of antrum. (Gen. prep. ROM 3-053).

EGG

Orange; 1.1 x 1.4 x 0.8 mm.

LARVA (pl. I. vig. 11)

First instar: Body color beige-brown; dark brown broad dorsal stripe; fine spiracular dark brown lines; head blackish brown; thoracic horns smooth, finely bifurcated, black; inferiorly to lateral lines a yellowish patch around the scolus on each segment. Length of first instar larva: 5 mm.

Second instar: Body color olivish-brown; darker brown broad dorsal stripe; spiracular lines dark brown; supra- and subspiracular lines yellowish, fine; horns with thorns, finely bifurcated; head very dark reddish cherry brown. Length of second instar larvae: 7 mm.

Third instar: Body color dark olive brownish; dorsally darker; spiracular space bordered on both sides by yellowish-whitish broken fine lines; subspiracularly broad outstanding vermillion line (broken at segments); additional little white tubercles (also on suranal plate) everywhere; horns long, with secondary thorns, ends shortly bifurcated; on dorsum in middle thin darker olive line and subdorsally on each segment thin broken vermillion lines; head as before. Length of third instar larva: 12 mm.

Fourth instar: No change, except head now light brownish-beige. Length of fourth instar larva: 20 mm.

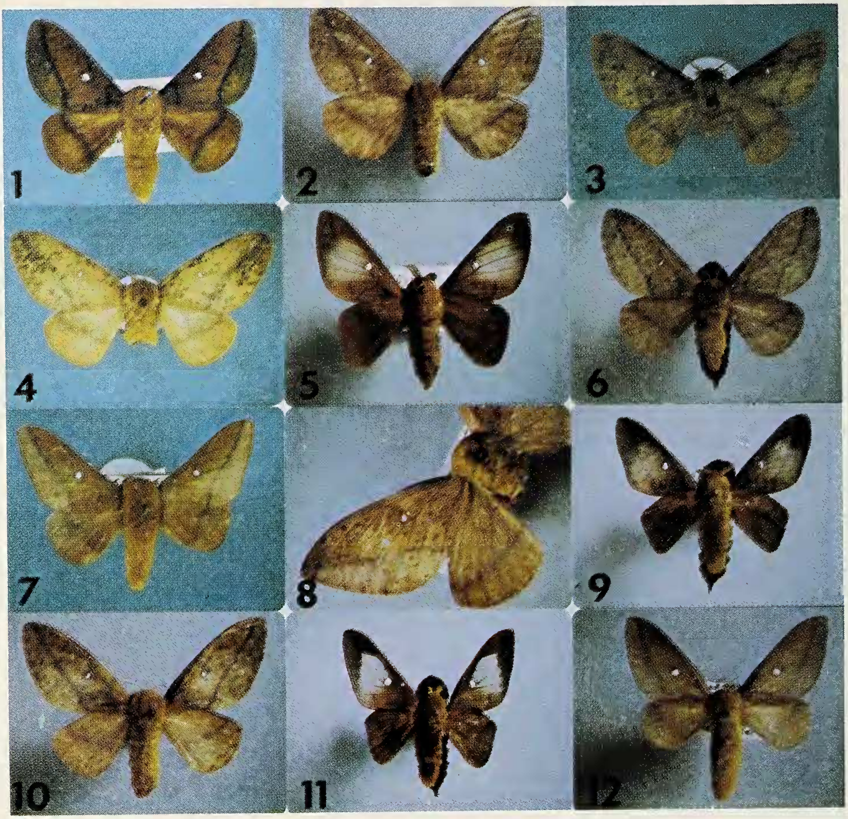

PLATE II. 1. *Anisota stigma* ♂, Clemson, South Carolina, reared *ex ovo* 21 July 1975 by J. C. E. Riotte (ROM). 2. *A. stigma* ♀, Clemson, South Carolina, 7 July 1975, at light, R. S. Peigler and J. W. McCord (Peigler Coll.). 3. *A. fuscosa* ♂, Leesville, Louisiana, *ex larva* 4 August 1960, R. O. & C. A. Kendall (ROM). 4. *A. fuscosa* ♀, same data as fig. 3 except date: 15 August 1960. 5. *A. consularis* ♂, St. Johns County, Florida, reared *ex ovo* 16 August 1974 by J. C. E. Riotte (ROM). 6. *A. consularis* ♀, Statesboro, Georgia, *ex larva* on *Quercus falcata* 8 July 1976, R. S. Peigler and J. W. McCord (ROM). 7.*A. manitobensis* ♂, Pembina Valley, Manitoba, *ex larva,* 17 April 1953, F.I.S. (ROM). 8. *A. manitobensis* ♀, Waushara County, Wisconsin, 3 July 1936, C. Harrington (ROM *ex* Sieker Coll.). 9-10. *A. peigleri* ♂ X *consularis* ♀, hybrid pair, Greenville, South Carolina/Statesboro, Georgia, 22 July 1977 and 17 September 1976, R. S. Peigler (ROM). 11-12. *A. virginiensis* ♂ X *discolor* ♀, hybrid pair, Pine Grove, Pennsylvania/Hamilton, Texas, 28 June and 20 July 1977, R. S. Peigler (Peigler Coll.).

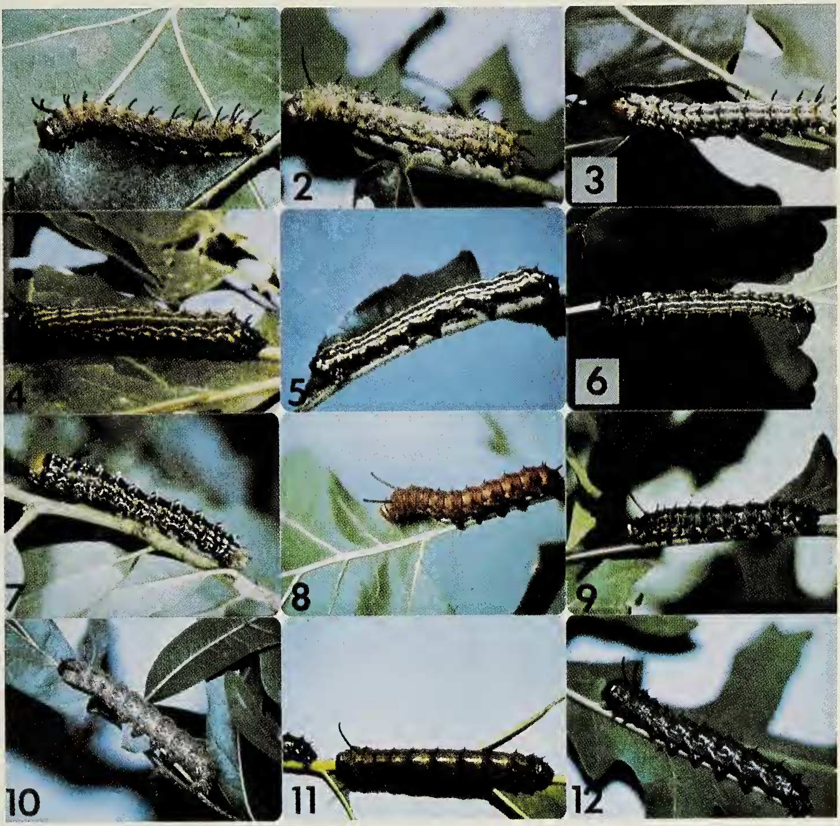

PLATE I. Mature larvae of *Anisota*. 1. *A. stigma*, Greenville, South Carolina. 2. *A. fuscosa*, Walker County, Texas. 3. *A. consularis*, St. Johns County, Florida. 4. *A. senatoria*, southeastern Michigan. 5. *A. finlaysoni*, Shannonville, Ontario. 6. *A. peigleri*, Clemson, South Carolina. 7. *A. assimilis*, Creel, Chihuahua. 8. *A. oslari*, Arizona. 9. *A. peigleri* ♂ X *consularis* ♀, hybrid. 10. *A. virginiensis*, Pine Grove, Pennsylvania. 11. *A. pellucida*, McClellanville, South Carolina. 12. *A. discolor*, Walker County, Texas.

N.B.: Plates I and II were inadvertantly transposed in the original color printing, and although out of order, they are properly numbered and labelled.

Fifth instar: No change, except for kind of silvery shine because of the many white tubercles all over body; lateral subdorsal lines a little thicker, vermillion; horns long (7-8 mm), black, somewhat roundly bent, without remarkable secondary thorns, ends no longer bifurcated; spiracular space not bordered anymore by anything. Length of fith instar larva: 35 mm. Headcapsule shown in fig. 5d, suranal plate in fig. 3d.

PUPA (pl. VII, fig. 7)

Dark brown; not too spiny; cremaster heavy set, originating from broad base, short and wide, bifurcation long, almost entirely straight, not too pointed.

DISTRIBUTION

This species ranges from coastal North Carolina deep into the Florida peninsula and across to Louisiana where it becomes parapatric with *A. discolor*. It is very common in coastal South Carolina through Florida, much less common in the piedmont of the former state. The presumed range into Tennessee, Arkansas and North Carolina where it probably contacts *A. virginiensis* needs elucidation.

TYPE MATERIAL

The name is based on Abbot's painting in J. E. Smith (1797: pl. 58). As this is only a vague basis for a taxonomic entity in the case concerned because of the extreme variation in the rendition of the plates in the various existing copies of the work in question, it was considered right to designate a neotype. As such was chosen the male holotype of *Anisota virginiensis sinulis* Riotte and with this the type locality fixed as Gainesville, Florida. Additional type data: taken 22 September 1955 by C. N. Patton in Gainesville, Florida. Location of neotype: Florida State Collection of Arthropods, Division of Plant Industry, Florida Department of Agriculture, Gainesville, Florida. In the said collection is also the female allotype of *Anisota virginiensis sinulis* Riotte, taken 21 September 1964 by J. W. Perry in Gainesville, Florida.

BIOLOGY AND REMARKS

The junior author has found larvae on *Quercus nigra* in South Carolina, Georgia, Florida and Louisiana. That oak, along with *Q. falcata*, are favorite hosts throughout much of the range. D. Baggett collected larvae in northeastern Florida on *Q. myrtifolia* and *Q. imbricaria*. J. D. Solomon sent us larvae in alcohol from coastal Mississippi collected on *Q. nuttallii* and *Q. lyrata*. Larval colonies are small, averaging only about ten individuals by the time the last instar is reached, because females deposit fewer ova at each site than do those of other species groups.

The moth is double-brooded throughout its range but the flight times vary considerably with latitude. Records range from 11 April at Punta Gorda, Florida, to 3 October at Oneco, Florida, so there might possibly even be a third brood at these lowest latitudes. During the summer the pupal stage lasts only about two weeks. Dominick & Edwards (1971) and Solomon (1971) reported on the circadian sexual activity of the moths.

It should be remarked that the larva shown in J. E. Smith (1797: pl. 58) on *Q. marilandica* definitely represents the present species, although the adults are not well recognizable.

MATERIAL EXAMINED

UNITED STATES. FLORIDA: no other data (AMHN, CNZ); Eglin (Hilton Coll.; Ft. Meade (FMNH); Gainesville (FSCA, LM, ROM); Indian River (AMNH);

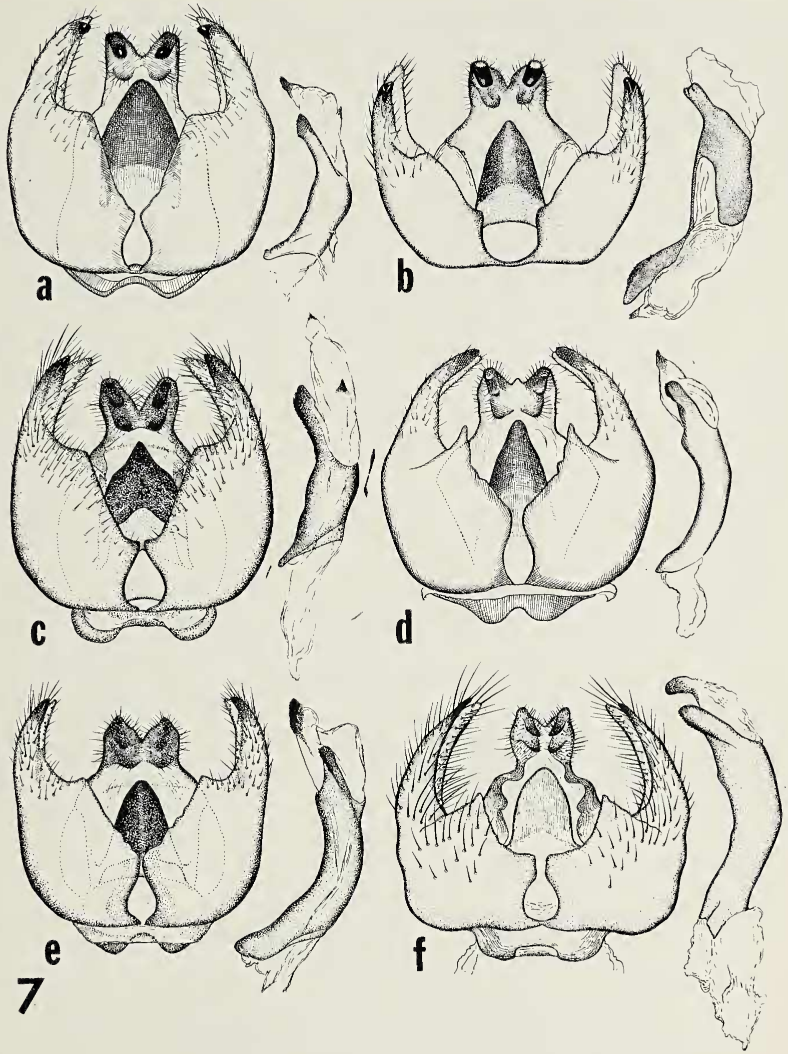

Fig. 7. Male genitalia, with aedoeagus removed and alongside: a. *A. senatoria,* b. *A. peigleri,* c. *A. finlaysoni,* d. *A. pellucida,* e. *A. virginiensis,* f. *A. discolor.*

Jupiter (AMNH); Largo (CNC); 5 km S. of Leesburg (FMNH); Oneco (AMNH); Orlando (AMNH); Parish (LM); Punta Gorda (FMNH); Swannee River State Park (LM); White Springs (BPBM). GEORGIA: Athens (CLU); Clarke Co. (CLU); Emory University (FSCA); Fish Eating Creek (FSCA); Statesboro (BPBM, LACM,

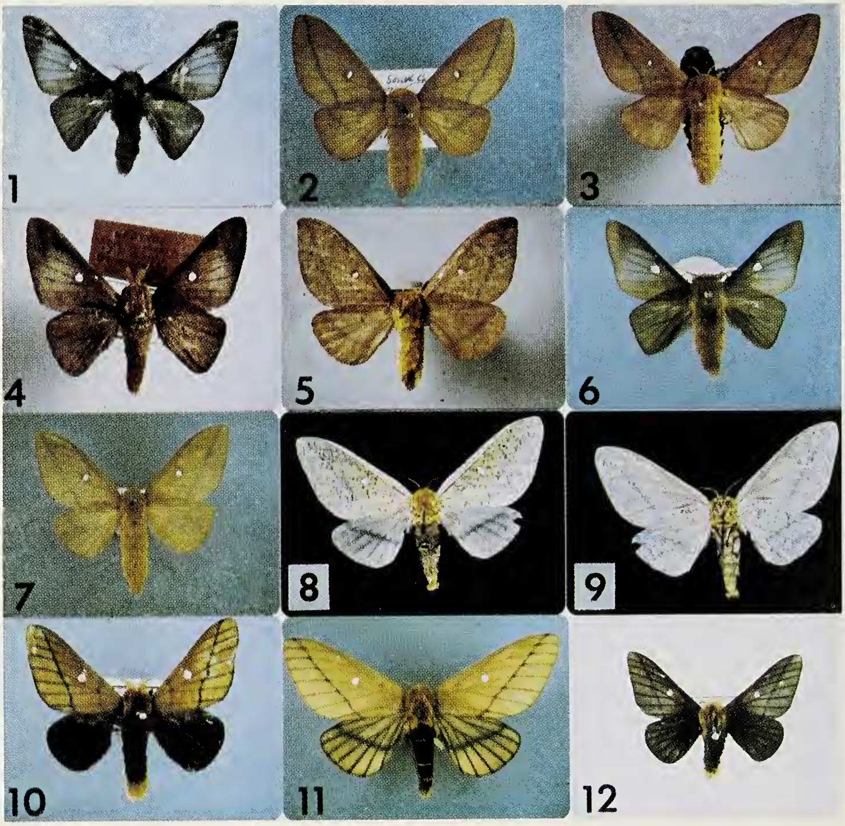

PLATE III. 1. *A. peigleri* ♂, Greenville, South Carolina, attracted 4:30 PM EDT on 7 July 1976 to a female of *A. consularis*, R. S. Peigler (Peigler Coll.). 2. *A. peigleri* ♀, Clemson, South Carolina, reared *ex ovo* 12 July 1975 by J. C. E. Riotte (ROM). 3. *A. peigleri* ♀, Clayton, Georgia, *ex larva* 18 May 1975, on *Quercus velutina*, R. S. Peigler and J. W. McCord. 4. *A. senatoria* ♂, Neotype, Gibsland, Bienville Parish, Louisiana, 21 August 1976, at light at Interstate 20 rest area, R. S. Peigler (AMNH). 5. *A. senatoria* ♀, same data as fig. 4 (Peigler Coll.). 6-7. *A. finlaysoni* ♂ ♀, Kingston, Ontario, 6 and 2 May 1970, J. C. E. Riotte (ROM). 8-9. *A. punctata* ♀, upperside and underside, holotype, 27 km W Linares, Nuevo Leon, Mexico, 23 July 1976, at light, R. S. Peigler (AMH), 10. *A. dissimilis* ♂, Zacualpan, Mexico, June 1915 (ROM *ex* AMNH). 11. *A. dissimilis* ♀, Oaxaca, Mexico, no date (ROM *ex* AMNH). 12. *A. dissimilis* ♂, Jalapa, Veracruz, May (MHNN), an unusually melanic male.

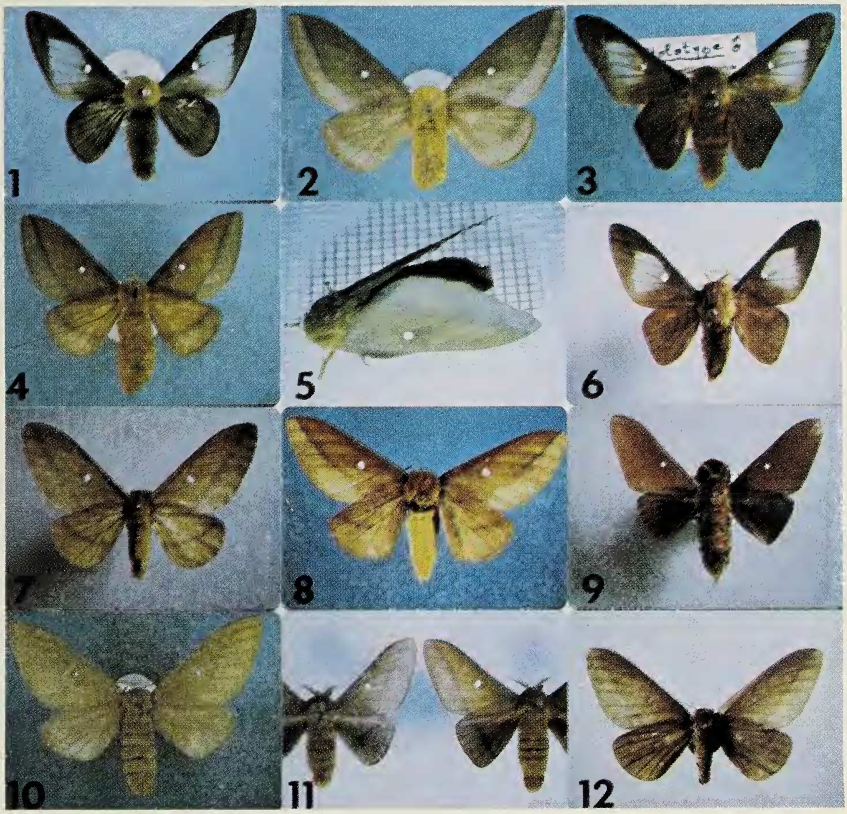

PLATE IV. 1. *A. virginiensis* ♂, Chaffeys Locks, Ontario, reared *ex ovo* 6 August 1970 by J. C. E. Riotte (ROM). 2. *A. virginiensis* ♀, Rondeau Provincial Park, Ontario, 22 June 1965 (ROM), 3. *A. pellucida* ♂, holotype of *A. virginiensis sinulis*, neotype of *A. pellucida*, Gainesville, Florida, 22 September 1955, C. N. Patton (FSCA). 4. *A. pellucida* ♀, McClellanville, South Carolina, reared *ex ovo* 1 September 1972 by J. C. E. Riotte (ROM). 5-6. *A. discolor* ♀ ♂, both College Station, Texas, reared 1976-1977 on *Quercus pubescens* in France by C. Lemaire (Lemaire Coll.), female in natural resting position. 7. *A. discolor* ♀, Claremore, Rogers County, Oklahoma, 19 August 1977, Peter Loy (AMNH). 8. *A. leucostygma* ♀, lectotype, Oaxaca, Mexico no date (MNHN). 9. *A. oslari* ♂, Pena Blanca Lake, Santa Cruz County, Arizona, reared on *Quercus kelloggii* by Earll M. Brown and emerged 23 June 1977 (Peigler Coll.). 10. *A. oslari* ♀, Jeff Davis County, Texas, *ex larva* 13 August 1968, R. O. & C. A. Kendall (ROM). 11. *A. assimilis* ♂ ♂, near Creel, Chihuahua, Mexico, ca: 2134 m, *ex larva* on *Quercus grisea* 26 May and 20 June 1979, R. O. & C. A. Kendall (Kendall Coll.). 12. *A. assimilis* ♀, Comitan, Chiapas, Mexico, June 1963 (ROM *ex* Lemaire Coll.).

ROM); Stonehenge (CLU). LOUISIANA: no other data (CalAcSci); Baton Rouge (AMNH, LSU, ROM); Edgard (ACM); Harahan (CMZ); L. Charles (AMNH); Pointe Coupee Parish (LSU); Prairieville (BPBM, DPI, LACM, LSU); Sorrento (AMNH); Sunshine (AMNH). MISSISSIPPI: Aditon (ROM); Bovina (AMNH, BMNH, LACM); Clinton (AMNH); Pearl (ROM); Tupelo (LACM); Vicksburg (AMNH, LACM). NORTH CAROLINA: Carteret Co. (AMNH); Fontana (CM); Whiteville (Peigler Coll.). SOUTH CAROLINA: Clemson (LACM, Peigler Coll., ROM); Greenville (Peigler Coll.); McClellanville (ROM); Manning (AMNH, LACM, Lemaire Coll., ROM); Orangeburg (LACM, ROM); Pendleton (BMNH); Six Mile (Lemaire Coll.); Summerville (FSCA). Examined 30 males and 40 females, dissected 7 males and 7 females.

Anisota virginiensis (Drury)

Bombyx virginiensis Drury, 1793: 23, pl. 13: 2.

Dryocampa virginiensis; Westwood 1837: 24, pl. 13: 2; Walker, 1855: 1496.

Anisota virginiensis; Grote, 1874: 261; Kirby, 1892: 739; Neumoegen and Dyar, 1895: 148; Dyar, 1896: 166; Beutenmueller, 1898: 440; Holland, 1903: 95, pl. 8: 9, 10; Packard, 1905: 102, pl. 20: 1-3 (adults), pl. 4: 1-5, pl. 5: 1-5, pl. 29: 1-1d, pl. 50: 1-1d, pl. 52: 1-1c (larvae); Forbes, 1923: 668; Bouvier, 1931: 19; Draudt, 1930: 814, pl. 142g; Schuessler, 1936: 218-220; Lemaire, 1976: 47.

Bombyx astynome Olivier, 1790: 43; synonymized: Westwood, 1837: 24; type locality: Carolina and Virginia; fixed by Ferguson, 1971: 80, as Virginia.

Phalaena (*Bombyx*) *perspicellina* Martyn, 1797: pl. 30: 88. Type locality unknown. New synonymy.

Dryocampa pellucida, Morris, 1862: 232.

ADULT

Male (pl. IV, fig. 1): Sexual dimorphism strongly developed. Head, thorax, abdomen brownish wine-red; the abdomen in some specimens with a tendency to be ochreous; legs ochreous; forewings brownish wine-red, hindwings somewhat more on the brownish side; postmedian line not very much accentuated; white discal spot large; underside of wings with an ochreous hue especially on the hindwings; dark scales very small and scarce, some may be detected almost always when examined under magnification; hyaline patch on forewing strongly developed. Outer margin of forewings straight making the wing triangular; of hindwings in most specimens rounded, however, all transitions to absolutely straight ones may be found in one and the same population, e.g., Pine Grove, PA. Length of forewing 18-20 mm (20 specimens measured).

Female (pl. IV, fig. 2): Much larger than male and not very thickly scaled; wings distinctly rounded; terminal area of wings greyish-purple, remainder brownish-ochreous; contrast may be strong between the two areas, however, in many specimens it is only slight; there may be found also some of the wine-red male coloring in some females; postmedian lines well expressed on both wings; white discal spot large; about the dark scales what is said under the male applies also here; underside of wings as upperside; abdomen, head, thorax, legs all ochreous. Length of forewing 24-29 mm (30 specimens measured).

Head: Laterofrontal suture visible; frontal protuberance transverse, not prominent; male antenna with 15 rami; posterior aspect of head showing two well developed lateral processes of the margin.

Legs: Epiphysis in male a little more than half as long as the tibia; rounded dorsally, straight ventrally, ending in a point, covered with very small hairs; in females only occasionally present, much smaller than in male, originating at beginning of second quarter of tibia, extending half way into third quarter, same form as in male. Empodium moderate, consisting of one tubercle with a single small seta. On anterior tibia only one obtuse process instead of the usual apical spines.

GENITALIA

Male (fig. 7e): Uncus M-shaped, heavily chitinized; gnathos not broad, triangular shield; lateral margins of valves almost straight; inner margin of valves more uneven than in *A. assimilis*; apex bifurcate, ventral part a little shorter, strongly chitinized, dorsal part twice as wide; free annellus heart-shaped, with high apices, the cleft strongly chitinized (as in *A. consularis*); aedoeagus different from all other species, except those of the group, rounded like a boomerang, carina with serrated ridge ventrally; vesica with one elongated spine-like, minutely serrate cornutus spically and in some populations with preapical one reduced to a chitinized plate or spot; proximal end wider in lateral view than in other species of the genus. (Gen. prep. ROM 3-002).

Female (fig. 8f): Very compact looking, especially the antrum; ostium narrow and strongly sclerotized; antrum wedgeformed cephalad; ductus bursae abruptly bent where bursa copulatrix is connected; lobuli vaginales very high; valves of ovipositors of almost uniform width, large and apically rounded. These last three characters diagnostic for the species. Sterigma as usual, perhaps not as wide as in other species. The ductus seminalis is connected almost on the dorsal side of the end of the antrum. Bursa copulatrix more or less rounded and not too large. Signum present in some specimens, in other absent. (Gen. prep. ROM 3-008).

EGG

Orange, more rounded than flat; 1.1 x 1.6 x 0.8 mm.

LARVA (pl. I, fig. 10)

First instar: Body color dark olive; headcapsule and anal plate black; subspiracular faint yellowish line just perceptible; horns on thoracic segment II black ending in two long setae; spiracles black with very indistinct bordering; spines on body not too strongly developed; length 5 mm.

Second instar: Body color light yellowish olive; headcapsule light beige brown; anal plate of body color but paler; horns on thoracic segment II very long and slender, setae much shorter than in first instar; some scattered white granulations; between subdorsal greenish lines a darker dorsal band; spiracular line also greenish; spiracles blackish with body colored border; length 12 mm.

Third instar: Body color greyish olive; headcapsule as before and still lighter; anal plate pale amber; horns on thoracic segment II shorter than before, the setae very reduced; white granulations on body more conspicuous; a very faint dorsal line (no band); subdorsal lines light pinkish; pinkish also a subspiracular band; spiracles black, almost no bordering, between two fine whitish lines; length 20 mm.

Fourth instar: Body color as before; headcapsule greenish; anal plate pale amber; horns on thoracic segment II shorter and thinner, no setae at end; white granulations as before; dorsal line more expressed; between the subdorsal pinkish lines patches slightly darker than the body; spiracles black with whitish bordering; conspicuous subspiracular pinkish band; length 25 mm.

Fifth instar: Body color greyish olive; headcapsule greenish; anal plate dull amber; horns on thoracic segment II almost smooth, clubbed, 6-8 mm long; white granulation not too dense over entire body; dorsal line fine; space between the pink subdorsal lines darkened in patches; the subdorsal lines now wider and more prominent; spiracles black with whitish bordering in a whitish, narrow, wavy band; subspiracular band also wide, pink; all the colors more saturated than in the instar before; length 42-55 mm. it should be noted that all the colors in *A. virginiensis* are pastel colors not strong colors as in *A. pellucida*. Headcapsule shown in fig. 5e, suranal plate in fig. 3e.

PUPA (pl. VII, fig. 8)

Of the same general type as usual in the genus, but more slender posteriorly, the lateral segmental thorns stronger, some double; the bifurcation of the cremaster with an inwardly bent bifurcation.

DISTRIBUTION

The species is very widely distributed; it ranges from Arkansas through Missouri northward to Minnesota and then east through Wisconsin, Illinois to the eastern seaboard south to Virginia; in Canada it extends from Manitoba eastward through Ontario and Quebec to Nova Scotia.

TYPE MATERIAL

Type material for the three names: *virginiensis, astynome* and *perspicellina* is not known to be preserved anywhere.

As type locality for *virginiensis* Drury names Virginia; as that of *astynome* Olivier gives Carolina and Virginia; Martyn does not mention type localities.

It is well known that the correct identity of the species has been questionable since Drury's (1773) original figure, which is in color but only certain as being a species of *Anisota*. Smith (1797), Westwood (1837) and Boisduval (1872) variously confused the Drury taxon with *A. pellucida* and even *A. senatoria*. Packard (1905) synonymized *A. virginiensis* and *A. pellucida*, and Morris (1892) even synonymized *A. virginiensis* to *A. pellucida*, making thus the senior synonym the junior one.

To finally solve this problem we are designating herein a neotype for both names: *virginiensis* and *astynome*.

With F. H. Rindge we select and designate as neotype for both names of *A. virginiensis* and *A. astynome* a female from Suffolk, Virginia, collected 19 June 1944 by Otto Buchholz. This neotype is in the American Museum of Natural History in New York.

BIOLOGY AND REMARKS

A. virginiensis is the widest ranging species in the North. The moths fly in June and July mostly. The species is sympatric with *A. manitobensis* in some areas. The preferred foodplant is *Q. rubra*.

Papers published which supposedly give the flight times of *A. virginiensis* (Dominick and Edwards, 1971; Solomon, 1971) actually refer to *A. pellucida*. However, we believe the flight time for both these species is the same time of day.

There is evidence that *A. discolor* and *A. virginiensis* share some characters which are not common to *A. pellucida*, In the fourth-instar larvae of the first two species the stripes are light pink, while in *A. pellucida* these stripes are magenta. The ova of *A. pellucida* are smaller and are mostly brown during embryogenesis, whereas the larger eggs of *A. discolor* and *A. virginiensis* go through a red phase before hatching.

MATERIAL EXAMINED

CANADA. MANITOBA: Morden (CNC); Thornhill (CNC). NOVA SCOTIA: Argyle (USNM); L. Kejimkujik (USNM); see also in the Proceedings of the Nova Scotian Institute of Science, Session of 1952-53 (Vol. XXII, Part 3), p. 209 under no. 846. ONTARIO: Aberdeen (FIS); Acton (CNC); Algonquin Prov. Park (McM); Banks (CNC); Bear I. (CNC); Benny (FIS); Bergland (CNC); Blueberry I. (ROM); Brent (FIS); Capreol (ROM); Chaffeys Locks (ROM); Chalk River (FIS); Grand Bend (CNC); Johns Falls (larva) (ROM); Kenebec I. (FIS); Latchford (FIS); Norman Twp. (ROM); Ottawa (CNC); Petawawa (FIS); Port Rowan (CNC); Rainy River (CNC); Rondeau Prov. Park (ROM); Rosebank (ROM); Sault Ste. Marie (CNC, McM); Severn Falls (FIS); Silver Water (FIS); Simcoe (CNC); St. Thomas (UWO); Sudbury (FIS); Trenton (CNC); Toronto (ROM); Vittoria (CNC); Washago (CNC). QUEBEC: Aylmer (CNC); Calumet (LM); Ft. Coulonge (CNC); Laniel (LM); Meach L. (CNC); Montreal (LM); Norway Bay (CNC); Orleans (LM-Sheppard Coll.); St. Johns (LM); Ste-Anne-de-Belle-vue (LM); Wakefield (CNC). UNITED STATES. ARKANSAS: no other data (AMNH). CONNECTICUT: Putnam (AMNH). ILLINOIS: Lacon (UIl); Oregon (city) (UIl); Palos Park (UIl); Putnam Co. (UIl). MAINE: no other data (YPM). MICHIGAN: Agr. College (MSU); George Reserve (MSU); Gull. L. Biol. Station (MSU); L. Orion (MSU); Wakelee (UIl). MINNESOTA: no other data (AMNH); Itassa Park (USPM); Ramsey Co. (USPM). MISSOURI: UMo Coll.: Columbia (also larvae); Curryville; Meramec Highlands; Roaring River State Park (larvae); Round Spring State Park (larvae); Vichy; Heitzman Coll. the following Counties: Benton; Bollinger; Boone; Carroll; Crawford; Cole; Jasper; Johnson; Lewis; Maries; Montgomery; Ozark; Randolf; St. Louis; Taney; Texas; Warren; Washington. NEW HAMPSHIRE: no other data (AMNH); Franconia (AMNH). NEW JERSEY: no other data (AMNH); Elizabeth (AMNH); Essex Co. (AMNH); Fort Lee distr. (AMNH); Montclair (AMNH); Morris Co. (AMNH); Newark (AMNH, FMNH); Ocean Co.; Orange Mts. (AMNH); Union Co. (AMNH). NEW YORK: Bear Mts. (AMNH); Bedford (AMNH, FSCA); Bronx (AMNH); Bronx Park (AMNH); Brooklyn (CNC); Buffalo (ROM); Clayton (AMNH); Ithaca (MSU); New York (AMNH). OHIO: Millport (CM); Summitville (UMo). PENNSYLVANIA: Delaware Water Gap (AMNH); Alleghany Co. (CM); Charleroi (CM); Finleyville (CM); Ingomar (CM); Jeannette (CM); Pine Grove (AMNH, LACM, Peigler Coll.); Pittsburgh (CM); Scranton (AMNH). RHODE ISLAND: Elmwood (CM); Rockland (AMNH). TENNESSEE: Johnson City (AMNH). VIRGINIA: Amherst (CM); Suffolk (AMNH). WISCONSIN: Balsam L. (USPM). Examined 100+ males, 175+ females, dissected 9 males and 11 females.

SENATORIA GROUP

Anisota finlaysoni Riotte

Anisota finlaysoni Riotte, 1969: 141; Ferguson, 1971: 76; Lemaire, 1976: 47.

Anisota senatoria (not J. E. Smith, 1797); Forest Lepidoptera of Canada (B. M. McGugan, Co-ordinator), 1958: 48 (partim). [Error of determination.]

ADULT

Male (pl. III, fig. 6): Sexual dimorphism strongly developed. Head, thorax, abdomen, legs, fore- and hindwings normal sepia brown and not too strongly sprinkled with dark scales in the apical area of forewing; hyaline patch on forewing clear; postmedian line well marked; white discal spot quite large; on the underside of wings a distinctive brass-yellowish suffusion. Outer margin of forewing very slightly concave between M_2 and Cu 1b, of hindwings almost all straight. Length of forewing 17-20 mm (16 specimens measured).

Female (pl. III, fig. 7): Thinly scaled. Unicolorous, pronounced tawny ochreous; only slightly sprinkled with dark scales at apex of forewing; postmedian lines on both wings straight and unconspicuous; white discal spot quite large; a purplish suffusion in the terminal area usually much reduced but in some populations occurring; underside of wings with ochreous-yellow suffusion. Outer margin of both wings rounded, the hindwings more so than the forewings. Length of forewing 24-30 mm (17 specimens measured).

Head: Laterofrontal suture strongly visible. Frontal protuberance transverse, insignificant. Male antenna with 18 rami. Posterior aspect of head showing no lateral projections, only a low convexity on either side, apex rounded.

Legs: Epiphysis in male well developed, broad, longer than two thirds length of tibia, width about half of length; one side rounded, the other straight, apex blunt, covered with very small hairs. In most females epiphysis absent, in others very small but of same form as in male. Empodium formed of two tubercles, the distant one well developed with a long, strong seta, the proximal one very small with a very small and thin seta.

GENITALIA

Male (fig. 7c): Uncus V-shaped, apices strongly sclerotized; gnathos a broadly rounded shield, usually with a pronounced triangular process arising apically; valves perceptibly curved distally; apex bifid, ends of almost equal length, ventral part of the bifurcation sclerotized, dorsal part wider; free annellus a ring tapering off apically. Aedoeagus short, straight, carina bent sharply, blunt, with a row of small serrations; vesica with two conspicuous triangular cornuti, the edge of each serrate; the one at the middle of the vesica with unusual thin, small triangular process dorsally; coecum of the same general form as in the other species. (Gen. prep. ROM 3-004).

Female (fig. 8e): Ovipositor valves rounded at apex; lobuli vaginales high, triangular with more or less pointed apex; ostium bursae a wide funnel-like structure; antrum absent; ductus bursae not sclerotized, short, sharply bent where bursa copulatrix is attached; bursa copulatrix small, round, signum mostly absent or very small; ductus seminalis connected at the very beginning of ductus bursae laterally. (Gen. prep. ROM 3-006).

EGG

The freshly laid eggs are of a bright yellow color, darkening after some days to a dark reddish brown. Before hatching they turn gray. The eggs are laid preferentially at the apices of the leaves of oak. They hatch after about 15 days and are approximately twice as big as the small eggs of *A. senatoria*.

LARVA (pl. I, fig. 5)

First instar: Light yellowish, body not hairy, longitudinally striped with shadowy blackish, faintly pigmented lines: a narrow one at the dorsum and the spiracles, two broader ones in between. The setae are thin and small and the two scoli on the second thoracic segment are only very slightly thicker than all the other ones.

Length of first instar larva: 5 mm.

Second instar: Coloration as in the mature larva: blackish-brown with yellowish stripes: two narrow dorsal ones extending only to abdominal segment 7 inclusive, a straight and somewhat subdorsal line, an undulate supraspiracular one interrupted between the segments, a straight infraspiracular and much interrupted line; the base of the infraspiracular spines, inferior to the infraspiracular stripe, is of the same color. Spiracles black. A light yellowish ventral median stripe. Prongs of the prolegs of the same color. Main difference with all other known larvae of *Anisota* is the absence of the elongated, thin and slender "horns" on the second thoracic segment.In their place are just two short scoli (1 mm long) which are only very slightly larger than all the remainder. Pronotum heavily chitinized, black with yellowish borders which coincide with the second lateral yellow stripe. Head very dark blackish red-brown, elongated, the frontal plate quite large. Length of second instar larva: 10 mm.

Third to last (fifth) instar: There is no perceptible change between the larva of the second instar and the following ones except for the length. This is a remarkable distinction from the larva of *A. senatoria*. Length of third instar larva: 21 mm; of fourth instar larva: 32 mm, of fith instar larva: 50 mm. Headcapsule shown in fig. 5c, suranal plate in fig. 3c.

PUPA (pl. VII, fig. 6)

Blackish brown; spiny and slender; cremaster bifid; the two forks stronger than in *A. senatoria* and well pointed.

DISTRIBUTION

Since the original description and the publication of Ferguson (1971) it was found that the distribution of the species corresponds to that of many other moth species in southern Ontario which occur at the north shore of Lake Erie and then again around Belleville and eastward.

TYPE MATERIAL

Type locality: Shannonville, Hastings County, Ontario. Additional type data: holotype male taken 28 June 1967 sitting at the end of grass stalk at about 1500 hrs; allotype female at the same date and time ovipositing on a white oak tree. Location of types: Royal Ontario Museum, Toronto, Ontario. Paratypes in: AMNH, BMNH, CM, CNC, FIS, FSCA, LACM, MSU, Peigler Coll., RIB, ROM, USNM, UWO, YPM.

BIOLOGY AND REMARKS

The flight period is from the last third of June to about the middle of July. In the laboratory pupae may fail to diapause.

The main foodplant is white oak. Also chestnut oak (*Quercus pini*) is found at the type locality and in some instances larvae of *A. finlaysoni* were found on same. In rearing experiments also other species of oak, especially red oak, were taken, and larvae transferred to red oak trees on the grounds of Queen's University Biology Station at Lake Opinicon, Chaffeys Locks, Ontario, completed their development on these but did not become established. Also the rare *Quercus muhlenbergi* was accepted in the laboratory as food by the larvae.

L. R. Finlayson (deceased 1965), Research Officer at the Research Institute, Canada Department of Agriculture, Belleville, Ontario, discovered the species in 1946 after a farmer in Shannonville, Ontario, informed the Institute that an unknown caterpillar defoliated his oak trees. Finlayson collected over the years, especially in 1957, considerable material of all stages of the species which he rightly recognized as new and undescribed. In 1966 finally all specimens accumulated in Belleville were turned over to the Department of Entomology and Invertebrate Zoology of ROM (nobody else being interested in it) where careful study supported Finlayson's suspicions and provided the stimulus for the present review of the genus *Anisota*.

On 28 June 1967 a fieldtrip was made to the original locality in Shannonville where the first observations had been made in 1946. One male and one female were found. The circumstances were the same as already observed by Finlayson: the male was sitting in the grass, the female was resting on a white oak leaf laying eggs. About 400 eggs were found in three bunches on three white oak trees, in addition to the eggs of the ovipositing female. All eggs were reared and material of all stages was preserved. A few adults emerged from the pupa only a short time after pupating, in September 1967 which was an especially warm month, and the same happened again in 1968.

Inspection in 1978 by both authors revealed the colony in Shannonville to be still strong.

The species has been reared in southern France from Shannonville eggs by C. Lemaire. Many larvae were dead in the first instar on the European *Quercus pubescens* which was easily accepted in the last instar. However, successful rearing was accomplished in five weeks on *Castanea vulgaris*. This is interesting and may perhaps give a clue to the sporadic distribution of the species if it should have originally preferred *Castanea* sp. and would after the great chestnut blight not have been able to adjust so easily everywhere to oak.

The species apparently is sympatric or nearly so with *A. senatoria* in some areas of Ontario. Elucidation of these ranges would be a worthwhile undertaking for some local lepidopterist in the area. We believe that our records for *A. senatoria* and *A. finlaysoni* are free from confusion because the determinations are generally based on larvae or dissected adults.

MATERIAL EXAMINED

CANADA. ONTARIO: Ameliabourgh Twp. (FIS); Barriefield (FIS); Belleville (CNC, FIS, ROM, UWO); Campbellford (FIS); Campbellville (FIS, ROM); Chippewa (CNC); Deseronto (CNC, ROM); Erinsville (FIS); Frankford (FIS); Glen Miller (FIS); Hagersville (ROM); Kingston (ROM); Lindsay (FIS); Mountain View (CNC); Napanee (CNC, ROM); Odessa (CNC, UWO); Otter Lake (ROM); Palermo (FIS); Rockton (ROM); St. Williams (ROM); Sheffield (CNC, ROM); Shannonville (CNC, ROM); Snyder (CNC, ROM); Thurlow (FIS); Tweed (FIS); Tyendinaga (FIS). UNITED STATES. MINNESOTA: no other data (AMNH); Green Lake (UCal); Minneapolis (FMNH); Olmstedt Co. (USPM). WISCONSIN: Lake Delton (Sieker Coll.); Chippewa Co. (CalAcSci). Examined long series of males and females, dissected 22 males and 15 females.

Anisota peigleri Riotte

Anisota peigleri Riotte, 1975: 105; Lemaire, 1976: 47.

ADULT

Male (pl. III, fig. 1): Abdomen, fore- and hindwings above strongly mahogany-brown; head, legs, fore- and hindwings beneath ochreous except for an apical purplish-gray marginal space; forewings above sprinkled with dark scales especially apically; beneath dark scales especially on hindwings; postmedian line easily perceptible on upper forewing and on all wings beneath; hyaline patch on forewings present but much covered with thin scales; white discal spot large. Outer margin as in *A. finlaysoni*, i.e. with forewing slightly concave between M_2 and Cu 1b, with hindwing perceptibly concave. Length of forewing 19-20 mm (12 specimens measured).

Female (pl. III, figs. 2, 3): Unicolorous lighter and of a clay brown with some orange hue, except for the marginal area of the forewings which shws on both sides slight purplish-gray hue, in some specimens (*ex*-larva, Clayton, Georgia) this purplish strongly expressed over entire wing surface; most specimens with strong sprinkling of somewhat clustered dark scales on both sides of the wings; some specimens with only a very few scales; white discal spot large. Outer margin of both wings slightly rounded. Length of forewing 25-32 mm (11 specimens measured).

Head: Unique sexual dimorphism in certain important characters: laterofrontal suture visible in male but obscurred in female; frontal protuberance slightly protruding in male but reduced in female. Male antennae with 12 rami. Posterior aspect of head ellipsoid, outline smooth without lateral projections.

Legs: Epiphysis slightly shorter than tibia, bulged unilaterally, densely covered with very fine, short hairs, observed in the male. Empodium very small with a short, weak seta.

GENITALIA

Male (fig. 7b): Uncus M-shaped, apices strongly sclerotized; gnathos similar to *A. finlaysoni*, i.e. reduction in width from and even narrowing into a sudden narrowness finally ending in a blunt end; in single specimens the apex of the gnathos is lip-formed; valves narrow; apex bifid, ends of unequal length, ventral part of bifurcation strongly sclerotized, dorsal part wider; free anellus a well-formed crescent. Aedoeagus long, straight, carina bent sharply, apex like a goose head with many little teeth on top of "head", still more than in *A. finlaysoni*; the proximal end tripartite; dorsally only very slightly chitinized; vesica with a well-developed cornutus on apex, while the preapical one may be present or absent.

Female (fig. 9b): Ovipositor valves rounded at apex, oblong, strong, large; lobuli vaginales not too high; ostium bursae wide; antrum absent; ductus bursae unsclerotized not very long; sharply bent where bursa copulatrix is attached as in *A. finlaysoni*; bursa copulatrix short and oblong; no signum observed; ductus seminalis connecting at beginning of ductus bursae.

EGG

Yellow; 1 x 1 x 0.8 mm. Turning reddish brown and then gray as development of embryo proceeds.

LARVA (pl. I, fig. 6)

First instar: Body color, anal plate included, ivory; headcapsule black; dorsal line thin, grayish-olive; horns on thoracic segment II long, bifurcate; on thoracic segment III shorter hornlike outgrowth, bifurcate, on a thicker base; spines all over body; long subspiracular bristles in horizontal row; on abdominal segment 9 bifurcate bristles on a slightly larger base.

Second instar: Body color yellowish; anal plate brownish-black; thin dorsal line grayish-olive and pale; a subdorsal and lateral stripe of same color about three times the width as the dorsal one; also a spiracular line and subspiracular rounded scoli on each segment. In some cases the line on dorsum and the stripes are dark blackish-olive. On both stripes and subspiracular region of each segment is a triangular horn; on the subdorsal stripes is also a smaller horn latero-caudally from the larger one. Thoracic horns only slightly bifurcate. Spiracles black. On segment anterior to anal plate is a dorsal larger horn on a base. Small blackish spots irregularly all over body.

Third instar: Body color jet-black just after molting, later becoming more olive-gray. Dorsal line black; broken whitish-yellow weak subdorsal lines; slightly thicker lateral ones of the same type. Spiracular area yellow as in previous instar. Thoracic horns long and only slightly bifurcate. On abdominal segment 11 and anal segment are single strong dorsal bifurcate spines and two smaller lateral ones, no spiracular spines. Anal plate black.

Fourth instar: Body color jet-black just after molting, some days later changing to olive-gray. Very spiny. Three yellowish broken lines on each side; subdorsally very faint broken line, absent in some cases. Horns long, clubbed with very fine bifurcate setae apically. The spiracular line is unbroken and the subspiracular scoli surrounded by yellow patches. All lines pale yellow, tending to whitish washed-out color. Caudal spines as in previous instar. larvae very shiny in this and previous instars (as in all species in the genus).

Fifth instar: Larvae now velvety jet-black; when viewed at certain angles a trace of olive-gray color perceptible. Very spiny; much more so than in larvae of *A. finlaysoni* and *A. senatoria* (consult pl. V). Subdorsal yellow lines often almost absent or only slightly visible as disjunct dashes; lateral lines also broken, sometimes only remnants visible; supraspiracular line intermittent; subspiracular line wavy and thicker; a round yellow patch surrounding the spiracle on thoracic segment II. On abdomen a narrow yellow line from second abdominal segment to posterior end, sometimes broken, this line much less evident than in *A. senatoria* and *A. finlaysoni*.

The chaetotaxis of the thoracic legs differs from that of both *A. senatoria* and *A. finlaysoni*.

PUPA (pl. VII, fig. 5)

Medium spiny; chestnut brown; cremaster bifurcate with lateral ecrescences, the latter apparently an important species-specific character (which also occurs in *Dryocampa*).

DISTRIBUTION

Anisota peigleri maintains high populations every year in upper South Carolina and adjacent areas of North Carolina and Georgia. The following South Carolina counties cover the area where the species appears to be most abundant: Anderson, Oconee, Pickens, Greenville; in outlying areas it becomes rarer and still further away (Florida and coastal South Carolina) it is difficult to find most years. The species may ultimately be found in eastern Tennessee, northern Alabama, and western Virginia, although *A. senatoria* may also occur in these areas. The distributional pattern is generally characterized by moderate elevations, being uncommon in higher mountains but common in Piedmont, with occasional populations encountered in coastal areas. The populations reported by Beal (1952) under the name *A. senatoria* possibly refer to the present species.

TYPE MATERIAL

Type locality: Clemson, Pickens County, South Carolina. Additional type data: holotype male taken 5 August 1974 at light by R. S. Peigler; allotype female taken at same locality 11 July 1974 at light by R. S. Peigler. Location of types: Royal Ontario Museum, Toronto, Ontario. Paratypes: one male and four females in ROM, one female each in AMNH, Lemaire Coll., Peigler Coll., all collected at the same locality during the same summer by the same collector.

BIOLOGY AND REMARKS

The larvae of this species are very abundant during September and October in the counties of South Carolina mentioned above under "Distribution". Usually a few lower branches are defoliated on medium-sized trees, but it is not unusual to see isolated small or medium trees completely defoliated. Non-native oaks such as *Q. palustris* planted in yards and parks are especially attacked. In Greenville County the larvae have been found on *Q. rubra* and *Q. marilandica*; in the Clemson area they occur on *Q. velutina*; in all these areas of upper South Carolina the favorites are however *Q. nigra* and *Q. falcata*. Larvae collected near Clayton, Georgia and seen in Asheville, North Carolina by the junior author were all on *Q. velutina*.

The junior author and other entomologists at Clemson University (see Clemson Univ. Coop. Ext. Serv., 1968) always assumed this near-pest to be *A. senatoria*. A brood of larvae which the senior author reared in Canada from eggs of the allotype, quickly demonstrated to him that two species were involved since he was familiar with larvae of *A. senatoria*. Once this fact became clear, all of the other differences in the immature and adult stages between the two species were readily found.

Larvae of *A. peigleri* are variable in the amount of orange striping, as in *A. senatoria*, but these stripes are more often broken and reduced in the former species. The amount of orange stripes present in *A. peigleri* appears consistent within colonies, i.e. sibling larvae resemble each other closely. The spines are longer in *A. peigleri*, and this trait is easily seen when a direct comparison is made of mature larvae of both species. In the adults, the outer edges of the right and left wings diverge more in *A. peigleri*, whereas they are closer to being parallel in *A. senatoria*. The forewings thus appear more produced in *A. peigleri*. Although the examples we figure do not show it, the white dot in the forewing of both sexes tends to be larger in *A. peigleri*. Other differences between these two species, including genitalic ones, are given in the formal descriptions of the two species. Narrower wings and more yellowish on the underside distinguishes the females of *A. peigleri* from those of *A. stigma*.

MATERIAL EXAMINED

UNITED STATES. FLORIDA: Pensacola (LACM); Gainesville (State Agric. Dept., Honolulu); Interstate-75 Florida Welcome Center (ROM); "Carolina, N. Amerika" (AMNH). GEORGIA: Athens (UGA); Atlanta (Lemaire Coll.); Clayton (LACM, Peigler Coll., ROM). NORTH CAROLINA: Asheville (LACM); Hendersonville (larval parasites with host remains (Peigler Coll., USNM). SOUTH CAROLINA: Clemson (AMNH, FSCA, LACM, Lemaire Coll., Peigler Coll., USNM); Anderson (CNC); Pickens (BMNH); Six Mile (ROM); Seneca (Peigler Coll.); Florence (CLU, Peigler Coll., UGA); Greenville (AMNH, BPBM, LACM, ROM, Peigler Coll., Lemaire Coll.); Westminster (AMNH, ROM); Moncks Corner (ROM). Examined 25+ males and 38 females, dissected 9 males and 8 females.

Anisota senatoria (J. E. Smith)

Phalaena senatoria J. E. Smith, 1797: 113, pl. 57.

Anisota senatoria; Huebner, 1818-1822: 193; Grote, 1864: 93; Packard, 1864: 384; Kirkby, 1892: 739; Neumoegen and Dyar, 1894: 147; Beutenmueller, 1898: 439, pl. 20: 3; Packard, 1905: 107-111, pl. 20: 10-12; Holland, 1915: 94; Forbes, 1923: 668; Bouvier, 1931' 22; Schuessler, 1936: 213-215; Draudt, 1930: 813; Ferguson, 1971: 73; Lemaire, 1976: 47.

Dryocampa senatoria; Harris, 1835: 72, 592; 1841: 292; 1862: 405, fig. 200; Walker, 1855: 1496; Fitch, 1859: 43; Morris, 1862: 231.

Adelocephala senatoria; Boisduval, 1872: 87.

ADULT

Male (pl. III, fig. 4): Sexual dimorphism strongly developed. Abdomen, thorax, fore- and hindwings above from dark brown in the south to lighter brown in the north with slight reddish hue, more expressed in the north; head, legs, fore- and hindwings beneath dark orange-ochreous except for an apical dark purplish-grey marginal space in forewings above sprinkled with dark scales especially apically; beneath dark scales more pronounced; postmedian line strongly perceptible on upper forewing and on all wings beneath; hyaline patch on forewings somewhat suffused with thin scales; white discal spot not very large. Outer margin as in *A. finlaysoni*, i.e., of forewing slightly concave between M_2 and Cu 1b, of hindwing almost all straight. Length of forewing 15-19 mm (39 specimens measured).

Female (p. III, fig. 5): Abdomen, thorax, head, legs, fore- and hindwings above and beneath from normally scaled brownish-yellowish ochreous with some orange in the south to lighter yellowish ochreous and thinner scaling in the north also in apparent cline, a more or less pronounced purplish suffusion in the terminal area; postmedian lines on both wings and on both sides in southern specimens strongly marked, in northern ones much weaker; white discal spot not very large; the sprinkling with dark scales may be heavy in the south and nearly absent in the north, it occurs on both sides of the wings; on the underside of the forewings apically a more or less pronounced purplish-grey marginal space. Outer margin of all wings evenly rounded. Length of forewing 26-30 mm (47 specimens measured).

Head: Laterofrontal suture slightly obscured; frontal protuberance well developed and protruding. Male antenna with 15 rami. Posterior aspect of head with scalloped margin and perceptible but rounded processes.

Legs: Epiphysiss in male very small, only 3/5 of length of tibia; not observed in female. Empodium very small with a tiny thin seta.

GENITALIA

Male (fig. 7a): Uncus M-shaped with heavily sclerotized apices; gnathos a triangular roadly rounded shield; valves slightly rounded, apex bifid, both ends almost of equal length, ventral part of the bifurcation strongly sclerotized, dorsal part much broader; free annellus a ring of uniform width; aedoeagus straight and short, carina bent ventrally, strongly sclerotized, proximal to apex a low comb with a few small thorns, apex itself blunt; vesica with cornuti, one small one at half-way and the other at the end spatulate with small thorns; proximal end of aedoeagus almost straight. (Gen. prep. ROM 3-001).

Female (fig. 8d): Ovipositor valves of medium size and rounded at apex; lobuli vaginales low; sterigma also low not prominent, but sclerotization more or less heavy; ostium bursae not too wide, no antrum; ductus bursae not sclerotized at all, straight, slender; bursa copulatrix elongate, signum absent; ductus seminalis attached in upper fourth of ductus bursae laterally. (Gen. prep. ROM 3-009).

EGG

Yellow. Eggs from Monroe, MI, 1 x 1 x 0.5 mm; from Connecticut 1.3 x 1.2 x 0.9 mm.

LARVA (pl. I, fig. 4)

First instar: Body color greenish-yellow; headcapsule black; anal plate not pigmented; thoracic horns on segment II long, smooth, clavate, with two terminal setae of equal length; thoracic legs dark colored; abdominal prolegs of body color; no lines perceptible; length 4 mm.

Second instar: Body color dark greenish, shiny; headcapsule, anal plate and anal legs jet black; yellowish green lines are now perceptible: a dark dorsal line; pale yellowish green subdorsal lines; a wider supraspiracular line of the same coloring, separated by a very narrow dark green line from a broad spiracular one and a row of conspicuous black tubercles; horns on segment I large, finely spinulated, less bifurcate than in the first instar; thoracic legs black, abdominal prolegs dark green, anal legs black; length 10 mm; in the southern populations up to 18 mm.

Third instar: Body color dark yellowish green to olive green; headcapsule and anal plate black; two narrow yellowish dorsal lines; yellowish subdorsal and supraspiracular lines; the spiracular line more narrow; spiracles black with yellowish border; horns on thoracic segment II black, long; length 15 mm; in the southern populations up to 23 mm.

Fourth instar: Body color now black; headcapsule and anal plate black; two dorsal yellow (or orange—depending on the population) lines; the subdorsal line very outspoken, not interrupted at the joints; the supraspiracular line wavy but not broken; the subspiracular line irregular and broken; on each segment a yellow (or orange) ornamentation below the subspiracular line on the body segment; the supraspiracular line is extended on both sides of the anal plate; horns on thoracic segment II longer and stronger than before; length 20 mm; in the southern populations up to 34 mm.

Fifth instar: Body color blackish brown; headcapsule and anal plate black; lines deep yellow ochreous or orange—depending on the population—two dorsal lines (unbroken); a subdorsal straight one (unbroken); a supraspiracular undulating one; a subspiracular one is broken by black intermittances and is bearing the subspiracular row of spines; all spines rather short (as in *A. finlaysoni*); same subspiracular ornamentation as before; ventrally a yellow ochreous stripe; spiracles black with yellowish border; horns on thoracic segment II as before (4 mm long, thin); all legs and prolegs black; length 35 mm; in southern populations up to 40 mm.

PUPA (pl. VII, fig. 4)

Spiny and not perceptibly broadened posteriorly. The cremaster bifid, the forks being slightly turned outwards, sharp and not too long.

DISTRIBUTION

From the Gulf states, especially Texas and Louisiana (also Mississippi according to Ferguson, 1971: 74), northwards to the Great Lakes, hence through the southwesternmost part of Ontario to the eastern seaboard and then south to the Carolinas and sporadically into Florida. The specimens mentioned by Packard, 1905, from Maine may well constitute the northern limit while the specimens mentioned from Quebec by Winn, 1912, were found to be misidentified *A. virginiensis.*

TYPE MATERIAL

With the discovery of *A. peigleri* it seemed necessary to tie the name *A. senatoria* to a neotype. We have selected a specimen from a southern state although none from Georgia was available.

We herein designate as neotype of *A. senatoria* the following male (pl. III, fig. 4): Gibsland, Bienville Parish, Louisiana, 21 August 1976, leg. R. Peigler. Additional type data: specimen collected at light at a rest area on Interstate 20. Other males and females collected with this neotype are deposited in several museums. Location of neotype: American Museum of Natural History, New York.

BIOLOGY AND REMARKS

We agree with Ferguson (1971) that Abbot's plate leaves no doubt as to the identity of this species. We do not, however, choose to restrict the type locality to Screven or Bulloch counties in Georgia as Ferguson (1971) assumed for both *A. senatoria* and *A. pellucida* in his text discussion.

Regarding the diagrammatic aspects of Abbot's plates see also for fuller discussion the above chapter. Larval and adult differences between *A. senatoria* and *A. peigleri* are enumerated under the latter species. Additional observations convince us that Abbot figured what we now call *A. senatoria* rather than what we call *A. peigleri.* If the "assumed" type locality of coastal Georgia be accepted, it is significant that the junior author failed to find *A. peigleri* in this area during three years of collecting *Anisota* there. The data supporting that *A. peigleri* and *A. consularis* share the same flight times imply that the two species could not coexist, and the latter occurs there.

As pointed out by Kimball (1965) and Ferguson (1971), this species is rare in the Southeast. In eastern Texas, northern Louisiana up through Missouri the species is very common and attains pest status (see Ignoffo *et al.*, 1973). This species is much commoner in Walker Co., Texas, than either *A. fuscosa* or *A. discolor* but becomes rarer westward; we have a record from Bastrop from R. O. Kendall. The insect is also abundant (although only periodically) in New England where Hitchcock (1958, 1961 a,b,c) carried out some excellent observations. We refer the interested lepidopterists to his papers. Additional literature on the pest status include Clarkson (1883), Claypole (1883), Fitch (1859) and Missouri Forest Pest Report (1973).

Specimens from Texas and Louisiana appear darker than those from the Northeast, although we find no larval differences. Benjamin D. Williams III reports, *in litt.*, that he has attracted males to "calling" females early afternoon, during the two hours following noon. He reports *Q. palustris* as a host record. In the southern populations it is possible that males fly later in the day since several were collected at light and the forewings are less transparent. Additional material and data from central states are needed.

There is an old specimen labelled "Mexico" in the Lemaire collection from the Hans Fruhstorfer collection which Lemaire kindly verified by dissection. Given what is said about "Mexico sensu lato" under *A. leucostygma* this specimen may well be one of the numerous Texas ones.

MATERIAL EXAMINED

CANADA. ONATRIO: Ailsa Craig (FIS); Arner (CNC); Breslau (FIS); Dereham (ROM); Frome (CNC); Grand Bend (CNC); Kingsville (FIS); Ojibway (44 larvae and 100 pupae *ex* 1947, original Finlayson research) (ROM); Poplar Hill (FIS); Ranelagh (ROM); Wallenstein (CNC); Winona (FIS); Yarmouth Centre (CNC). UNITED STATES. ARKANSAS: Crawford Co. (larvae) (UArk); Hope (LM). CONNECTICUT: Mansfield (AMNH). FLORIDA: no other data (AMNH); Archbold Biol. Station, L. Placid (AMNH); Monticello (MCZ). DELAWARE: Delaware City (CM); New Castle Co. (AMNH). ILLINOIS: Algonquin (UIl); Palos Park (UIl). INDIANA: Hessville (FMNH); Knox (AMNH, FMNH, YPM); N. Judson (UIl). IOWA: Decorah (AMNH). LOUISIANA: Dry Creek (larvae) (LSU); Gibsland (AMNH, BPBM, LACM, Lemaire Coll., Peigler Coll., ROM, USNM). MASSACHUSETTS: Chatham (MCZ); Martha's Vineyard (AMNH, LM, YPM). MICHIGAN: Agric. College (MSU); Joseph Co. (MSU); Monroe (and larvae) (ROM); Ramona (LACM); Wayne Co. (MSU). MINNESOTA: no other data (AMNH); Hennepin Co. (USPM); Long Prairie (LACM); St. A. P. (USPM). MISSOURI: Bagnell (LACM, Sieker Coll., YPM); Phelps Co. (larvae) (UMo); Pike Co. (Heitzman, *in litt.*); Stone Co. (larvae) (UMo); Texas Co. (larvae) (Peigler Coll., ROM). NEW JERSEY: no other data (MJCZ); Bay Head (MJCZ); Clementon (ROM); Cranford (AMNH); Elizabeth (FMNH); Jamesbourgh (AMNH); Lakehurst (AMNH); Morris Co. (AMNH); Newark (AMNH, CM); Paterson (AMNH). NEW YORK: Albany (AMNH); Brooklyn (CNC); Buffalo (CM, ROM); Long Island (AMNH); New Windsor (CalAcSci); New York (AMNH, CM, CalAcSci, LM); West Farms (CM). NORTH CAROLINA: Southern Pines (LM); Sylva, Jackson Co. (FMNH). OHIO: Anna (LACM); Millport (CM, ROM, UMo); Summitville (CM, ROM, UMo). PENNSYLVANIA: no other data (CalAcSci); Alleghany Co. (CM); Delaware Water Gap (AMNH); Lititz (FMNH); Pittsburgh (CM); Rock Hill Furnace (CM); Rockpoint (CM); Scranton (AMNH). RHODE ISLAND: no other data (MCZ); Glenwood (CM); West Kingston (AMNH); Providence (CM). SOUTH CAROLINA: no other data (CIU); Greenville (larvae) (Peigler Coll.). TENNESSEE: Burrville (FMNH); McKenzie (CM). TEXAS: Bastrop Co. (Kendall Coll., ROM); College Station (Peigler Coll., ROM); Jasper (larvae) (ROM); Marshall (LACM); Nacogdoches (AMNH); San Jacinto Co. (ROM); Stubblefield L., Walker Co. (AMNH, BPBM (and larvae), LACM, Lemaire Coll., ROM). VIRGINIA: Kauhana (MCZ). WISCONSIN: Wausau (LACM). Examined 114 + males, 114 + females, dissected 16 males and 12 females.

STIGMA GROUP

Anisota consularis Dyar

Anisota consularis Dyar, 1896: 166; Packard, 1905: 106-107, pl. V: 8; Bouvier, 1931: 23; Draudt, 1930: 814; Kimball, 1965: 69, pl. III: 23-25; Ferguson, 1971: 72; Lemaire, 1976: 47.

Anisota stigma (not Fabricius, 1775); Ferguson, 1971: 67,72.

ADULT

Male (pl. II, fig. 5): Sexual dimorphism strongly developed. Head, Thorax, abdomen, legs, fore- and hindwings dark sepia-brown and strongly sprinkled with dark scales, even on underside; hyaline patch on forewing very thinly covered with scales; postmedian line well perceptible, especially on hindwing; white discal spot well-developed; on underside of wings orange tinge. Outer margin of both wings almost straight. Length of forewing 19-21 mm (21 specimens measured).

Female (pl. II, fig. 6): Head, thorax, abdomen, legs ochreous brown; forewings raw sienna to rosy brown (quite variable); hindwings darker and usually with a rosy tinge; all wings strongly sprinkled with dark scales; postmedian lines weak but sometimes well expressed; white discal spot quite reduced. Outer margin of both wings strongly convex. Length of forewing 26-30 mm (19 specimens measured).

Head: Laterofrontal suture slightly obscured. Frontal protuberance perceptibly protruding. Male antenna with 18 rami. Posterior aspect of head distinctly rounded at apex, processes slightly rounded.

Legs: Epiphysis observed only in males; ¾ of length of tibia; very convex dorsally midway along its length; straight ventrally; ending in narrow point; covered with short bristles; bearing on the ventral margin somewhat longer ones. Empodium one thin tubercle with one medium-sized seta.

GENITALIA

Male (fig. 6c): Uncus narrowly M-shaped, apices chitinized in a very peculiar way, the sclerotization forming a ridge of variable intensity; lateral borders of gnathos sinuate, apically forming a triangular rounded projection; valves basally and laterally very straight; parts of bifurcation of almost equal length, the dorsal part twice as wide as the ventral part; free annellus heart-shaped, strongly chitinized in cleft between the low apices. Aedoeagus very short, carina bent, straight, its apex with a row of small teeth; vesica very narrow with two small similar cornuti, the apical one with a few small teeth; proximal end not as sharply outlined as in the other species. (Gen. prep. ROM 3-030).

Female (fig. 8b): Ovipositor valves large, elongate; lobuli vaginales low; sterigma of medium breadth, not as much lipformed as in the other species; ostium bursae quite narrow; ductus bursae somewhat bottle-shaped, narrowing towards bursa copulatrix which is conspicuously oval and in the specimens inspected had a signum in the form of a round plate with concentric circles of chitinization; ductus seminalis attached laterally just after the beginning of ductus bursae. (Gen. prep. ROM 3-031).

EGG

Yellowish, 1 x 1.1 x 0.6 mm.

LARVA (pl. I. fig. 3)

First instar: Body color pale yellowish with a slight greenish tinge; headcapsule jet black; anal plate of body color; fine dorsal line olive; subdorsal line same color, twice as thick as dorsal one; spiracular line same color, waved, interrupted at segments; long spines on each segment subdorsally, on a thick conelike base, black; long horns on thoracic segment II bifurcate; short horns on thoracic segment III bifurcate; length 3 mm.

Second instar: Body color as in first instar, however, some larvae tending to a more dark coloring; headcapsule light brown; anal plate also; dorsal line narrow olive-black; subdorsal lines same color washed out, much wider; a washed out olive supraspiracular line bordered by a whitish line on each side; an olive black spiracular line with light bordering; spines now short; also horns on thoracic segment II only of normal length, bifurcate; short, bifurcate horns also on thoracic segment III; length 4.5 mm.

Third to fith instars: Body color fleshy to red-brown; headcapsule reddish-beige-brown; anal plate of body color, however, in flesh colored larvae both, headcapsule and anal plate are with all the feet red-brown; dorsal, subdorsal, supraspiracular and spiracular lines olive-blackish with the tendency to the black; often all lines bordered by a whitish space so that entire larva looks much more white than colored because of many round white spherish ecrescenses all over the body; larvae with only few white ecrescenses show the body color between the lines; spines very strongly expressed; spiracles blackish with whitish border; thoracic horns on segment II clubbed, 10 mm long; short scoli on segment III bifurcate; on segments 8 and 9 longer scoli, on segment 9 only one in the middle; length in third instar 10 mm; in fourth instar 25 mm; in fifth instar 32 mm. Headcapsule shown in fig. 4c, suranal plate in fig. 2c.

PUPA (pl. VII, fig. 2)

Compared with pupae of the other species of *Anisota* quite slender and of even width; not very spiny; cremaster short and compact; bifurcation straight outwards, very pointed; color lighter brown.

DISTRIBUTION

Although previously only known from widespread records in Florida, the junior author collected the species in Long and Bulloch counties of coastal Georgia. The latter area is very close to the state line of South Carolina so that one might expect the species in that state (but only near the coast) but it was not found in northern Charleston County after many years of intensive collecting there by the late R. B. Dominick. The moth might also be found eventually in other states on the Gulf Coast. The range is evidently limited by an ecological need for a mild climate.

TYPE MATERIAL

Type-locality: West Palm Beach, Florida. Additional type data: reared from larvae found in January 1896 on live oak. Location of types: United States National Museum, Washington, DC; the male type designated by Ferguson (1971) as lectotype, August 1896; the female type 15 September 1896. Types were examined by the junior author.

BIOLOGY AND REMARKS

It is apparent unfortunately that no previous author has had a clear understanding of the species, including Ferguson (1971) who questioned the color figures in Kimball (1965, pl. 3, figs. 23, 24 and 25). These do indeed represent *A. consularis*, as the senior author verified these specimens (in FSCA) by dissection. Ferguson's figures for this species (1971, pl. 5, figs. 16, 17 and 18) are correct, but his figure 5 on the same plate is also *A. consularis*, not *A. stigma*. This latter female was verified (in USNM) by the junior author. Ferguson (1971: 72) also questioned the correct identification of the figure in Draudt (1930, pl. 142f), saying it "is an obvious *stigma*". This may be true or the figure is just as likely correct, especially if one considers the artist may have "corrected" the transparent forewings with the belief these had been rubbed.

Although it is now abundantly clear that Ferguson's "Floridian *stigma*" is actually *A. consularis*, he was correct in seeing the relationship of it to the Texan *A. fuscosa*. In these two species there is ground color variation from light beige to rust to light orange to purplish brown in both sexes, while specimens of *A. stigma* are almost always rusty colored.

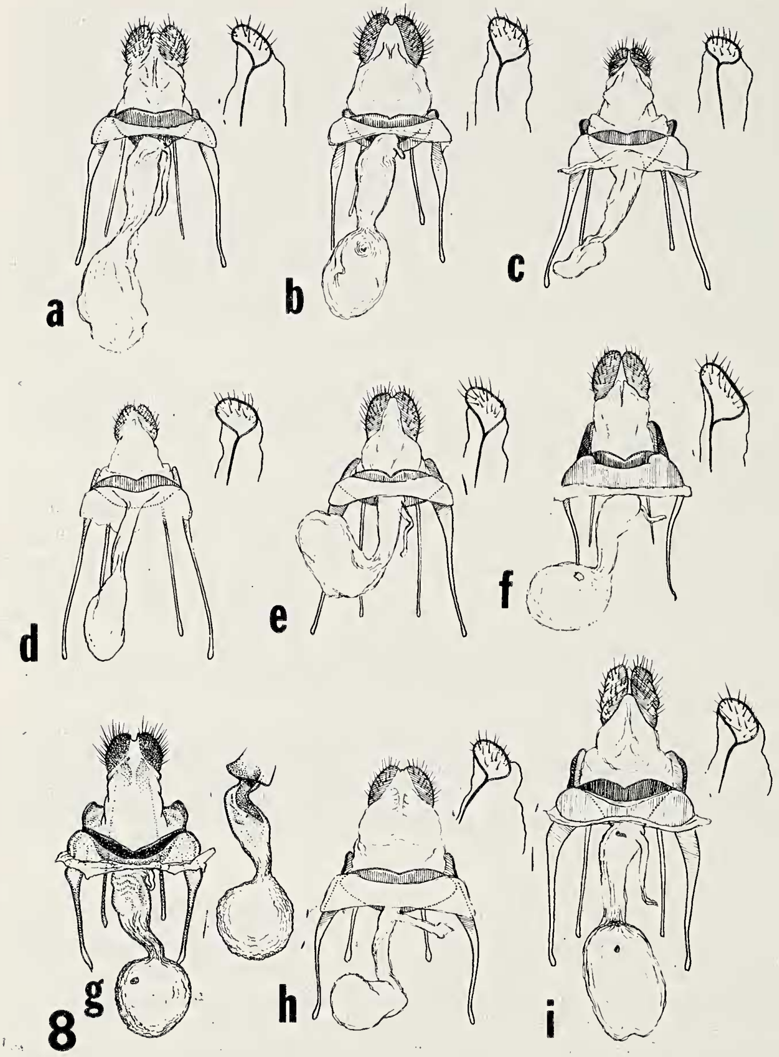

Fig. 8. Female genitalia, with lateral view of ovipositor alongside: a. *A. stigma*, b. *A. consularis*, c. *A. manitobensis*, d. *A. senatoria*, e. *A. finlaysoni*, f. *A. virginiensis*, g. *A. leucostygma*, h. *A. oslari*, i. *A. assimilis*.

The mature larvae can be greenish cream, or brownish, or pink fleshcolored, the latter color form with a black and white lateral stripe on each side. The pink form was figured by Packard (1905, pl. 5, fig. 8). All the larvae within a brood may be one of these color forms, or such may not be the case. This explains a remark in Packard

(1905: 107) about larvae of *A. consularis* being found "in company *with* those of *A. stigma*", in an area far south of the known range of the latter species. These color variations occur in mature larvae of *A. stigma* and *A. fuscosa* also.

Until now, the only reported host was live oak, *Quercus virginiana* (Dyar, 1896; Packard, 1905; Ferguson, 1971). The junior author collected larvae in Bulloch Co., Georgia, on *Q. nigra* and *Q. falcata* and also on these two trees in central Florida. D. Baggett collected them in Duval Co., Florida, in dry sandy areas on *Q. laevis* and *Q. myrtifolia*.

In Georgia the species flies in late July through early August judging from larval finds. In Florida records are mainly July through September depending on latitude but we believe the species is strictly univoltine.

The relatively high ratio of females over males in collections leaves no doubt that males are day-fliers. Reared females emitted pheromone in upper South Carolina at the flight time of *A. peigleri*. Since these two species are entirely alloptaric, having the same flight times poses no problem of hybridization in nature. This presumed flight time is additionally supported by the only partially developed transparentness of the forewings in the males.

MATERIAL EXAMINED

UNITED STATES. FLORIDA: no other data (AMNH); Cassadega (CNC, FSCA, Hilton Coll.); Crystal River (LACM); Gainesville (FSCA); Jacksonville (AMNH, LACM); Lake City (USNM); Largo (CNC); Lutz (AMNH, CM, ROM); Martin in Marion Co. (ROM); Miami (AMNH, CM); Palm Beach Co. (USNM); St. Johns Co. (ROM); Stemper (CM); Stuart (USNM); Summer Haven (CM); Suwanee Springs (Lemaire Coll., Peigler Coll.). GEORGIA: Long Co. (larva) (ROM); Statesboro, Bulloch Co. (AMNH, LACM, Lemaire Coll., Peigler Coll., ROM). Examined 40 males, 22 females, dissected 3 males, 3 females.

Anisota fuscosa *Ferguson* **New Status**

Anisota stigma fuscosa Ferguson, 1971: 70; Lemaire, 1976: 47.

ADULT

Male (pl. II, fig. 3): Sexual dimorphism not marked in this species. Head, thorax, legs, abdomen, fore- and hindwings almost unicolorous reddish brown, only terminal area of forewings with a mostly only slight purplish hue, the basal area without such hue. Forewings sprinkled with dark scales in varying density; hindwings not or only with very few dark scales in terminal area. No hyaline patch on forewing; postmedian line on both wings blackish-purplish, not strongly developed; antemedian line only slightly expressed or even absent; white discal spot prominent; middle field not contrasting (as it is in *A. stigma*). Outer margin of somewhat pointedly triangular forewings more straightened than rounded; of hindwings rounded. On the underside the unicolorous reddish brown is overlaid with some ochreous orange; terminal areas wholly or at least apically with purplish hue; only postmedian lines expressed. Length of forewing 20-21 mm (10 specimens measured).

Female (pl. II, fig. 4): Head, thorax, legs, abdomen, fore- and hindwings unicolorous clay brown with very slight purplish hue in terminal area. Forewing strongly sprinkled with dark scales; hindwings only slightly developed; antemedian line very slight; white discal spot small. Outer margin of wings as in male. On the underside unicolorous clay brown, dark scales massed apically on forewings and over entire surface of hindwing. Length of forewing 32 mm (4 specimens measured).

Head: Laterofrontal suture very much obscured; frontal protuberance very perceptibly protruding; male antennae with 16 rami; posterior aspect of head triangular with flat simple or double rounding on each side between base and tip.

Legs: Epiphysis of ¾ length of tibia; ventrally slightly rounded; dorsally highly rounded in middle; ending in blunt point; covered with fine bristles, ventrally with somewhat longer fine hairs. Empodium one tubercle with one strong, not too short seta.

GENITALIA

Male (fig. 6b): Overall impression square; uncus a strong, broad W; gnathos evenly proceeding triangular shield, somewhat pointed; longer than in *A. stigma*; valves rounded, apex bifid, dorsal bifurcation not much longer than ventral one which is strongly sclerotized; free annellus a low crescent of even height; aedoeagus short; carina rounded at apex, strongly sclerotized, with a comb of not too prominent little teeth, not too large, pointed and thorned cornutus apically and a preapical one which may be a sharp thorn (as in *A. consularis*) or just a very slightly sclerotized spot or anything in between, this being observed only in *A. fuscosa*. (Gen. prep. ROM 3-159).

Female (fig. 9a): Ovipositor valves large and round apically; the basic part conspicuousy long, longer than in any other investigated species of *Anisota*; lobuli vaginales strong; antrum strong developed, almost as in the *A. virginiensis* group with chitinized wedge-form into ductus bursae; ductus bursae twice twisted, first time after antrum making sharp left turn, then where bursa copulatrix attaches turning to the right; ductus brusae a wide and strong "hose"; bursa copulatrix quite elongated with a small round chitinized mark as signum; bursa and ductus showing a narrow network of fine lines. (Gen. prep. ROM 3-160).

EGG

Light yellow, round; size approximately like that of *A. stigma*.

LARVA (pl. I, fig. 2)

First instar: Body color ivory; headcapsule brown; anal plate brown; thoracic legs brown; no dorsal line; horns on thoracic segment II brown, bifurcate with thin seta on each end; 2 rows of subdorsal brown scoli with seta; supra- and subspiracular scoli very small with seta; spiracles very light brown; length 8 mm.

Second instar: Body color ivory; headcapsule beige; anal plate brown; only short setae on horns and scoli; subdorsal scoli now already well-developed; spiracular line, dorsal line and field between subdorsal scoli brownish shadowed; spiracles brown; scoli on 8th and 9th segments not different; length 13 mm.

Third instar: Body color beige; headcapsule beige; anal plate beige; scoli with lateral white secondary ones; broad dorsal band brown between rows of scoli; supraspiracular scoli weak, subspiracular ones stronger developed; spiracles brown with light yellow frame; brownish band laterally between spiracular and dorsal scoli (weaker than dorsal band); 2 scoli on 8th segment strong and long; on 9th segment only 1 scolus also long and strong in the middle of the segment; length 20 mm.

Fourth instar: Body color beige; headcapsule beige; anal plate beige; thoracic legs beige; scoli as before; 3 well-developed brown bands: dorsal, spiracular and between subspiracular row of scoli; between the bands the beige body color; subspiracular scoli on a beige pot; beige also between subdorsal row of scoli and small supraspiracular scoli; spiracles brown with yellow trimming; scoli on 8th and

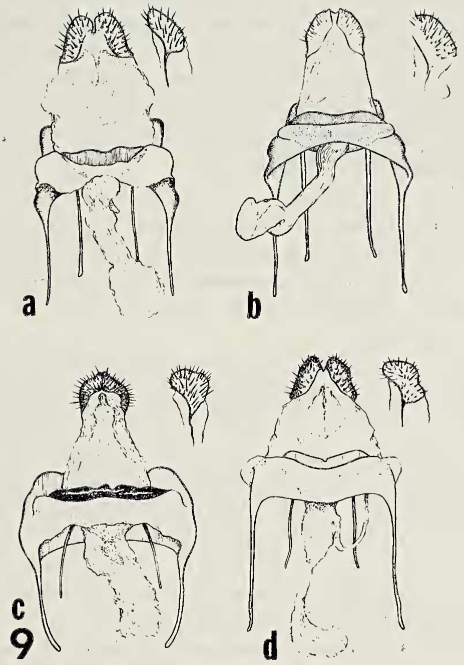

Fig. 9. Female genitalia, with lateral view of ovipositor alongside: a. *A. fuscosa*, b. *A. peigleri*, c. *A. pellucida*, d. *A. discolor*.

9th segments prominent; on all brown bands many white spots and round ecrescenses; thoracic horns 11½ mm long, clubbed with 2 obtuse ends with very small seta each; length 25 mm.

Fifth instar: Body color beige; headcapsule beige; anal plate beige; thoracic legs beige; body covered with many white spots and round ecrescenses; a very fine blackish dorsal line in the middle of a blackish brown band between the subdorsal rows of not too prominent black scoli; horns on thoracic segment II blackish, clubbed, only 5 mm long; a lateral band, a little narrower than the dorsal one, between the small supraspiracular and the also small spiracular scoli; scoli on 8th and 9th ssegments only slightly stronger than the subdorsal ones; length 45 mm. Headcapsule shown in fig. 4b, suranal plate in fig. 2b.

PUPA (pl. VIII, fig. 1)

Chestnut brown as in other species in the *A. stigma* group; cremaster very strong and prominent; arising from a wide and short base; especially the bifurcation very pronounced.

DISTRIBUTION

This species ranges far into central Texas (Kerrville) beyond the grassland prairies but is much commoner in the forests of eastern Texas. We figure a pair from

Leesville, Louisiana, where Roy and Connie Kendall collected the larvae on which the larval descriptions are based. In western Louisiana *A. fuscosa* ranges eastward at least to Choudrant but *A. stigma* occurs commonly at Vicksburg, Mississippi (B. Mather, *pers. comm.*), only ca. 150 km farther east. In southern Louisiana the range probably does not extend as far east. The species probably occurs in Oklahoma but we have no records for that state. We do not believe that *A. stigma* occurs in Texas unless near the state line with Arkansas.

TYPE MATERIAL

Type-locality: Giddings, Lee Co., Texas. Additional type data: holotype female taken 15 August 1908 by R. A. Cushman, type no. 71495 United States National Museum. Type examined by the junior author. Most of the paratypes were collected in eastern Texas by A. and M. E. Blanchard.

BIOLOGY AND REMARKS

The color forms of the adults and larvae discussed in this section under *A. consularis* also exist in the present species, but these variations are even more striking in both adult ground color and mature larvae. One rare larval color form is very dark brown (almost black as in *A. senatoria*). The head, prolegs and anal plate are orange. It is not dissimilar to the hybrid larva shown in pl. I, fig. 9. No larvae of *A. stigma* or *A. consularis* which we have seen approach this form in darkness, but larvae of *A. fuscosa* are usually of the lighter forms.

The most important and obvious trait of the larva of *A. fuscosa* is the presence of the broad dark dorsal band which occurs in all instars except the first. It is absent in some mature individuals of the pink color form.

Larvae found on several species of oak such as *Q. stellata* in College Station and *Q. nigra, Q. falcata* and *Q. marilandica* in Texas counties and Louisiana parishes to the east. The junior author searched unsuccessfully for larvae at the type locality (Giddings) on *Q. nigra* growing along a stream. The caterpillars are exceedingly delicate in captivity, and usually die from disease. Of large numbers collected at various instars during three consecutive autumns in Walker Co., Texas, by the junior author, very few survived to pupate and no pupae produced adults. R. Kendall reported similar difficulty. However, C. Lemaire successfully reared a brood in southern France on *Castanea vulgaris*.

The flight period extends from 25 May to October but the peak is in early September of what we believe is one brood per year. The long flight period reflects the large population level in some areas of its range. Males are commoner at lights than females, as in *A. stigma*.

MATERIAL EXAMINED

UNITED STATES. LOUISIANA: Choudrant (AMNH, BMNH, LACM, Lemaire Coll., Peigler Coll.); Gibsland (AMNH, LACM, Lemaire Coll., Peigler Coll., ROM); Leesville, Vernon Parish (Kendall Coll., ROM); Many (Kendall Coll., LACM); Spring Ridge, Caddo Parish (larvae) (LSU). TEXAS: Bryan (larva) (TAMU); Cherokee Co. (TAMU); College Station (LACM, Peigler Coll., TAMU); Fort Worth (CalAcSci); Giddings (USNM); Handley (larva) (USNM); Huntsville State Park (USNM); Jasper Co. (larvae) (LACM); Kerrville (USNM); Milam, Sabine Co. (Kendall Coll.); Nacogdoches (BPBM, Peigler Coll.); Shepherd (USNM); Stubblefield Lake Recreation Area, Walker Co. (larvae) (AMNH, LACM, Peigler Coll., ROM, USNM); Tennessee Colony (USNM), Tyler (TAMU). Examined long series of males and females, dissected 5 males, 6 females.

Anisota manitobensis McDunnough

Anisota manitobensis McDunnough, 1921: 73; Brodie, 1929: 98-100, figs. 1-3 (biology); Ferguson, 1971: 71; Lemaire 1976: 47.

ADULT

Male (pl. II, fig. 7): Head, thorax, abdomen, and legs brownish orange; strong purplish suffusion on both wings; basic color dull orange; no hyaline patch on forewing;postmedian line dark purple and well-developed; white discal spot prominent (in one specimen the white spots have a white anterior branch as in *Sphingicampa blanchardi* Ferguson); underside of wings as on upperside. Outer margins of both wings weakly rounded. Dark sprinkling of wings usually lacking. Length of forewing 19-23 mm (10 measured).

Female (pl. II, fig. 8): Like male but larger. Length of forewing 26-30 mm (4 measured).

Head: Laterofrontal suture totally obscured; a slightly perceptible convexity all along it; at occiput a small oval concave spot. Frontal protuberance broadly rounded. Male antenna with 15 rami. Posterior aspect of head very scalloped with conspicuous rounded processes.

Legs: Epiphysis found only in male, about half as long as tibia, dorsally rounded, ventrally straight, ending in a ventrally bent point, covered with short hairs, the ventral margins bearing quite long and straight hairs. Empodium small, one tubercle with one seta.

GENITALIA

Male (fig. 6d): Uncus V-shaped, apices (⅓ of total length of each arm) strongly set back and heavily sclerotized; gnathos broadly rounded triangular shield as in *A. stigma*, but with blunt apex; valves strongly rounded, giving entire structure a circular appearance; apex of valves bifid, both ends of almost equal length; ventral part of bifurcation strongly sclerotized, dorsal part only a little wider; free anellus crescent-shaped. Aedoeagus very broad and very short, on both sides slightly convex; carina bent in a smooth curve, its apex rounded with only a few tubercle-like processes instead of the usual teeth; vesica with two strong cornuti at the usual locations; both with a few uneven teeth, the preapical one with knoblike base (as in *A. stigma*); proximal end straight as usual. (Gen. prep. ROM 3-016).

Female (fig. 8c): Ovipositor valves medium sized, strongly rounded at apex; lobuli vaginales approximately as high as in *A. finlaysoni*; sterigma strongly sclerotized, higher than usual, having on either side a peculiar triangular ventrally-pointed form; ostium bursae quite wide; ductus bursae slightly sclerotized, a very strong tubular structure, gradually curved ventro-laterally; bursa copulatrix usually small, longitudinal, shaped somewhat like a shoe; signum, if present, a round patch with an arrowhead-like scaling in the center; ductus seminalis connecting at the very beginning of ductus bursae. (Gen. prep. ROM 3-017).

EGG

According to Brodie (1929): laid in clusters, "ovate and flattened, 1.51 mm by 1.25 mm, bright sulphur yellow, shiny, quite opaque and perfectly smooth". After one week darkening to brown and hatching after 13 days.

LARVA

The following description of each of the instars is taken directly from the paper by Brodie (1929):

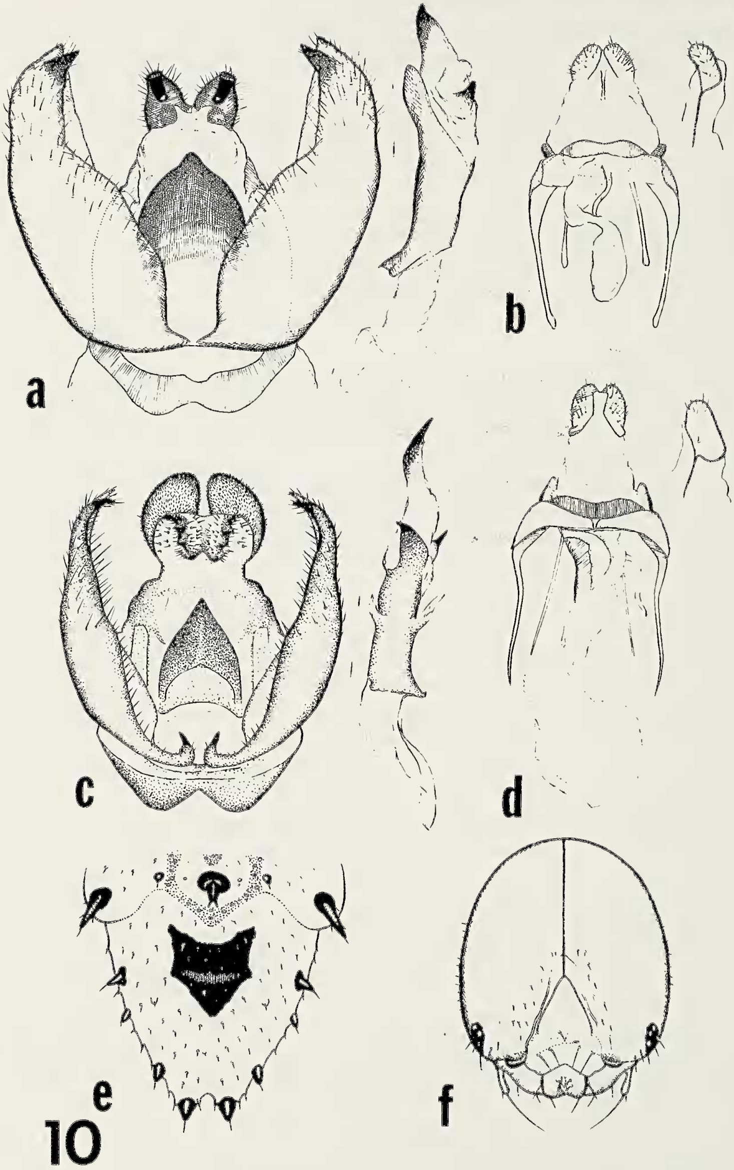

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Fig. 10. Morphological structures. a-b. Male and female genitalia of *A. dissimilis*. c-f. Male and female genitalia, suranal plate and head capsule of larva of *Dryocampa rubicunda*.

First instar: Creamy white, head shiny black; a wide dorsal and a narrow lateral brownish black line; spiracle brownish; the usual horns on the second thoracic segment. Changing of color in development to light and dark tan and black. Length: 3 mm.

Second instar: Shiny black, head dark tan; two dorsal cream colored stripes; a short light cream colored stripe diagonally through each spiracle; spiracles black; ventral side dull cream to buff; thoracic horns 2.2 mm, bifurcating at tip. Length: 7 mm.

Third instar: Head light tan; dorsal cream colored stripes present; spines, previously all black, now black at base and snow white toward tipi spines on anal segment almost entirely white; short white streak diagonally through each spiracle; ends of prolegs brown (previously grayish); colors of larva changing rapidly through development; black parts becoming dark brown, e.g. the body; dorsal cream colored lines becoming a dark shade of buff. Very shiny in this stage. Length: 10 mm.

Fourth instar: Head light tan, body shiny dark brown; two lighter brown dorsal stripes; spiracles black; horns on second thoracic segment shiny black with white branches, 5 mm long; other spines similarly colored; anal segment now dark brown (previously black) with scattered white spines; prolegs dark brown; white on spines giving larva appearance of being covered with hoar-frost (similar in *A. stigma*). Colors changing during development to light pinkish brown. Length: 22 mm.

Fifth instar: Little change from previous instar; head paler tan; true legs changed from black to pale tan; body light pinkish brown; many more spines now white; spiracles black with light pinkish border; horns on second thoracic segment 6 mm long; the area between the two dorsal lines with a thin central black line and with dark shading on either side of this line. Length: 50 mm.

PUPA (pl. VII, fig. 3)

Reddish brown; evenly wide leading to a dome-like last segment with a strong medium sized bifid cremaster; the forks strong and wide but not very pointed.

DISTRIBUTION

This moth was previously only recorded from southern Manitoba until we obtained specimens from three localities in Wisconsin from Mr. William E. Sieker (part of these we deposited in ROM and AMNH as indicated under "Material Examined"). The species probably also occurs in North Dakota and should certainly be found in Minnesota.

TYPE MATERIAL

Type locality: Aweme, Manitoba. Additonal type data: male holotype collected 4 July 1907 and female allotype collected 23 June 1904 both by Norman Criddle. Location of types is CNC with paratypes in CNC and USNM. We examined all of these.

BIOLOGY AND REMARKS

Brodie (1929) fed his larvae on *Quercus macrocarpa* Michx. He got his larvae from Mr. T. M. Short. The insect has been taken in recent years by Manitoba lepidopterist Mr. C. S. Quelch.

The flight period is June and July, the records for Manitoba being for both months, those of Wisconsin only for July.

As given under our remarks on the distribution, this species can now be listed as part of the United States fauna. The Wisconsin material required dissection for verification of the determination because most were heavily spotted as in *A. stigma*. The original description (McDunnough, 1921) and Ferguson (1971) state that *A. manitobensis* completely lacks this sprinkling and most of the museum material we saw bears this out. No problems, however, should arise in distinguishing the two species since they are apparently allopatric and the latter has more pointed forewings. Some specimens of *A. stigma* (in AMNH) from Rhode Island and Massachusetts appear very much like *A. manitobensis* with reduced or absent sprinkling and pink coloring in the postmedian area. The present species is sympatric with *A. virginiensis*; see maps 31, 32 in McGugan (1958).

MATERIAL EXAMINED

CANADA. MANITOBA: Aweme (CNC); Darlingford (AMNH, CNC); Deer Lodge (CNC); Kelwood (CM); McCreary (Peigler Coll.); Pembina Valley (CNC, ROM); Pine Ridge (Peigler Coll.); Riding Mtns. (CM, USNM); St. Vital (CNC); Transcona (Lemaire Coll.); Winnipeg (CNC, USNM). UNITED STATES. WISCONSIN: Arlington (ROM); Madison (one from University of Wisconsin Arboretum) (Sieker Coll.); Waushara County (AMNH, ROM). Saw 17 males, 8 females, dissected 3 males and 2 females.

Anisota stigma Fabricius

Bombyx stigma Fabricius, 1775: 563; Olivier, 1790: 42; Kerr, 1910: 110 (types).

Phalaena Bombyx stigma; J. E. Smith, 1797, II: 111, pl. 56.

Dryocampa stigma; Harris, 1841: 292.

Adelocephala stygma; Boisduval, 1871: 86.

Anisota stigma; Huebner, 1818-1822: 193; Beutenmueller, 1898: 430, pl. 20, fig. 4; Holland, 1903: 94, pl. 9, figs. 9, 10; Packard, 1905: 98-102, pl. 20, figs. 4-9; Forbes, 1923: 667; Draudt, 1930: 813; Bouvier, 1931: 17; Schuessler, 1936: 215-218; Kimball, 1965: 69.

Anisota stigma stigma; Ferguson, 1971: 67; Lemaire, 1976: 47.

ADULT

Male (pl. II, fig. 1): Head, thorax, abdomen, legs, fore- and hindwingss ochreous reddish-brown; forewings sprinkled with many dark scales, hindwings less; no hyaline patch on forewings; postmedian line on both wings dark purplish and well-developed; antemedian line weak to well expressed; white discal spot prominent; terminal area of forewings with more or less outspoken purplish hue; basal area shows this hue to a lesser degree; middle field never with it. Outer margin of all wings rounded. On the underside the ochreous ground color more pronounced against the brownish tones; the purplish in many specimens strong apically on fore- and hindwing; only postmedian lines strongly expressed. Length of forewing 19-24 mm (25 specimens measured).

Female (pl. II, fig. 2): Like male, larger, often with more brownish than reddish overtones and rarely even leaning to yellowish. When marked purplish suffusion appears with decreased black sprinkling or no purplish suffusion with much sprinkling indentification can be difficult and genitalic dissection can be helpful. Also the fact that the anterior wings are broader and more strongly convex in the outer margin should make the decision easier. The white discal spot is conspicuous. Length of forewing 27-36 mm (17 specimens measured).

Head: Laterofrontal suture obscured; frontal protuberance very perceptibly protruding; male antennae with 15 rami; posterior aspect of head with triangular rounded large thorns.

Legs: Epiphysis in males a little more than half the length of the tibia, dorsally rounded, ventrally straight, ending in a point, covered—especially ventrally—with rather long, dense hairs; in females, if present, only very rudimentary; empodium small with a very short seat (see: Oiticica, 1940: pl. 12, fig. 2).

GENITALIA

Male (fig. 6a): Overall impression pronouncedly square. Uncus with strongly sclerotized apices in the form of a broad M; gnathos a triangular shield with rounded apex, wider than in *A. peigleri, A. senatoria* and *A. virginiensis* and not as long as in these; valves strongly rounded and bent distally, apex bifid, the dorsal bifurcation longer than the ventral one which is strongly sclerotized; free annellus conspicuously crescent shaped; aedoeagus short, carina bent and rounded at apex, strongly sclerotized with a comb of thorns; vesica with pointed and thorned cornutus apically and another halfway with a knob-like base ending in a trifurcation; proximal end of the same general form as in the other species. (Gen. prep. ROM 3-045).

Female (fig. 8a): Ovipositor valves large; strongly rounded at apex; lobuli vaginales low; sterigma compact, strongly sclerotized; ostium bursae of medium width; ductus bursae not sclerotized, but a straight, strong, tubular structure; bursa copulatrix sometimes very small, normally, however, large, elongate, ovate; signum mostly absent, sometimes a round slightly sclerotized patch present; ductus seminalis attached in upper fifth of ductus brusae, laterally. (Gen. prep. ROM 3-042).

EGG

Light yellow, more round and not so much flattened; 1.3 x 1.5 x 0.7 mm.

LARVA (pl. I. fig. 1)

First instar: Body color pastel yellow; headcapsule black; anal plate also black (note here difference from Packard, 1905: 99, who says that the anal plate is pale, of the color of the body, not pigmented); thoracic horns on segment II very long, bifurcate; on segment III bifurcate already at base, shorter, base brownish; spines on all segments, on a base, this base brownish on segment 1, on the other segments blackish, on segment 9 one only large scolus on a base, bifurcate with setae on both ends; dorsal line very thin, olivish, secondary spines all over the body in a horizontal row subspiracularly; spiracular line greyish-olive; length 3 mm.

Second instar: Body color darker into brownish; headcapsule black; anal plate black; dorsal line narrow, blackish; subdorsal lines wider, blackish; supraspiracuar and spiracular lines not so wide and fainter in color; spiracles black; length 9 mm.

Third instar: Body color reddish-brown; headcapsule dark mahogany, anal plate black; horns on thoracic segment II black, perceptibly barbed; anal legs with a large, red, triangular spot; abdominal prolegs dull red with a black spot; the lines showing in the second instar become faint, reduced to traces; some white granulation begins to appear over the entire body; first traces of two lateral pinkish lines appear; the three dorsal lines are blended in one another forming a broad, pale reddish-brownish band; on each side of the head a pale, whitish line; length 16 mm.

Fourth instar: Body color reddish-brown, headcapsule dark mahogany; anal plate black; horns on thoracic segment II less spinulated than in the third instar, with white granulations, 10 mm long; on thoracic segment I six large, strong, forked scoli, not bifurcate, with a single seta; spiracles black with a thin whitish bordering;

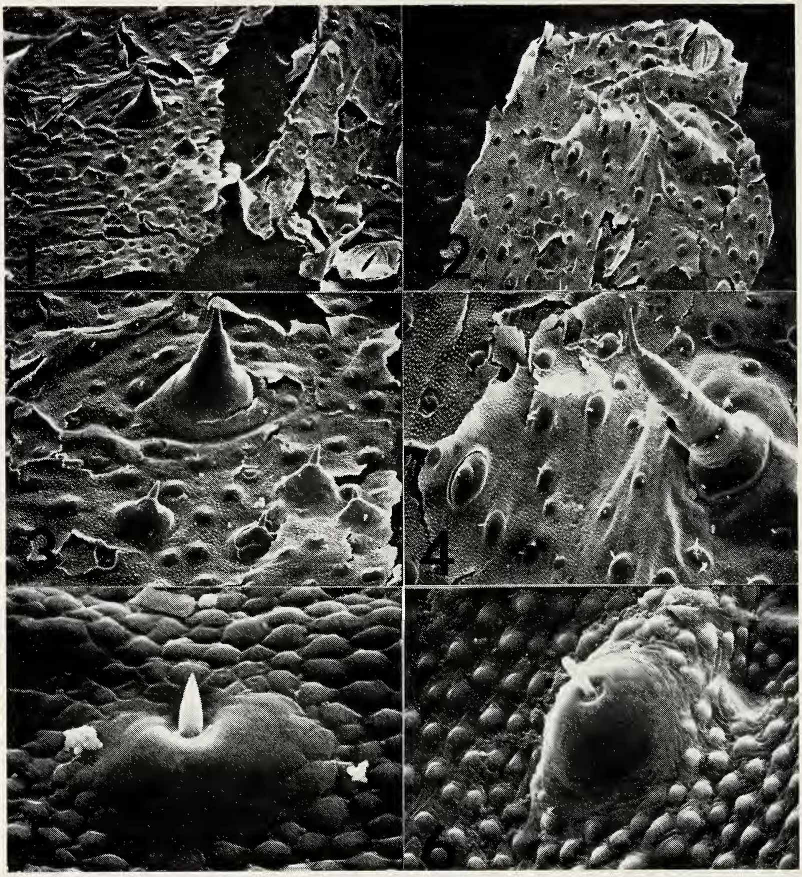


PLATE V. Scanning electron micrographs of larval integument. 1, 3, 5. *A. senatoria*. 2, 4, 6. *A. peigleri*. Scale of figs. 1-2 is 22 mm:1 mm, of figs. 3-4 is 16 mm:300 μm, of figs. 5-6 is 16 mm:30 μm.

color of anal legs verying between dark reddish and black; thoracic legs and abdominal prolegs dark pitchy; any lines almost not perceptible; length 32 mm.

Fifth instar: Body color brown; headcapsule dark mahogany; anal plate brownish; supraspiracular lines now better perceptible, greyish-pinkish; the whole larva very much as the one of the fourth instar otherwise; length 48 mm.

NB: Packard, 1905: 101, mentions an occasional sixth instar that we, however, were not able to observe in any of our rearings.

Headcapsule shown in fig. 4a, suranal plate in fig. 2a.

PUPA (pl. VII, fig. 1)

Posterior segments decreasing only slightly in diameter; the spines are conspicuous; cremaster long and strong, bifurcation weak; in this the pupa is different from all other known puape of any *Anisota*; color chestnut brown.

DISTRIBUTION

This species does not occur as far to the north as *A. senatoria* and *A. virginiensis*. We find it, however, widely distributed along the eastern seaboard from Florida to Massachusetts; westward through extreme southern Ontario to Minnesota, Kansas, Arkansas. There are no specimens known from Mexico.

TYPE MATERIAL

Type-locality: "America Meridionalis". Location of the two cotypes: Collection of insects of the University of Glasgow, Scotland. The female specimen (lower one on pl. VI, fig. 3) is hereby designated by us as lectotype.

Boisduval, 1871, had expressed some doubt as to the identity of this species which was figured for the first time by J. E. Smith, 1797, in both larval and adult stage. Boisduval bases his contention on the fact that Fabricius states as type-locality "America Meridionalis" and not "America Borealis", as might be expected if the species came from the United States. However, when Fabricius named the species there did not yet exist any United States of America and America just meant the British Colonies in North America (see Oxford Dicitonary), hence "Am. Merid." would be what we call today the "Southern States" including Spanish possessions like Florida and Mexico. Moreover, the types, preserved in the Hunter collection and reproduced here after an original photograph made for this purpose in 1967, show without any reasonable doubt specimens of *A. stigma*.

BIOLOGY AND REMARKS

This species is so widespread and well-known that very little new information can be offered here. The moth has been collected with ultraviolet light by the junior author atop Mt. Mitchell, North Carolina, the highest point in eastern North America. It is generally common in the northern and southern states of the eastern half of the continent. The northern range into Canada needs additional records to delineate it.

One error which keeps creeping up into dealings with *A. stigma* is the record in McGugan (1958): "near North Bay in northern Ontario". The original report shows as locality Bear Island, Joan Township, Nipissing District. it was made in 1953 from a larval collection. However, from Bear Island there is an *ex* larva female of *A. virginiensis* in CNC *ex* FIS from 1956. The identification of the original report was in the meantime changed to "Anisota sp." (P. D. Syme, Canadian Forestry Service, Insect Pathology Research Institute, Sault Ste. Marie, Ontario, *in litt.*). Also North Bay is far from "southern Ontario" (Ferguson, 1971: 68) which should have elicited some suspicion in using this report again.

A. stigma is uncommon in central Florida and absent southward in that state. Specimens in the AMNH and others sent us by D. Baggett all originating in the panhandle of Florida average considerably smaller than material from elsewhere. Additional material, with associated preserved larvae, from the Gulf coast area would be interesting.

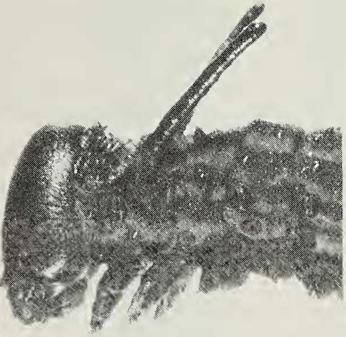
At Clemson, South Carolina, the junior author found larval colonies in the university arboretum on *Q. michauxii* and *Castanea mollissima*. Also at Clemson he once found larvae on *Q. alba*, his only observation of this oak species ever being utilized by *Anisota* in a southern state.

Seasonal flight times vary with latitude, altitude, and weather for the particular year, but most adults are taken in June, July or August. The circadian flight times were mentioned in a previous section. Variation in larval coloring is cited under the text of *A. consularis*. Resemblance of adults in New England to those of *A. manitobensis* is discussed under the latter species.

The Nova Scotia record given below needs verification due to absence of records from Maine, New Hampshire, Vermont and Quebec.

MATERIAL EXAMINED

CANADA. NOVA SCOTIA: Truro (CNC). ONTARIO: London (ROM); Port Colborne (CNC); Queenston (CNC); St. Williams (CNC, FIS); Simcoe (CNC). UNITED STATES: ALABAMA: 8 km NE Eutaw (AMNH); Ida (CalAcSci); Loxby (AMNH); Wilmer (AMNH). ARKANSAS: no other data (AMNH); Blue Springs Campground (Heitzman Coll.); Bluff City (AMNH); Camden (LACM, Peigler Coll.); Chidester (Lemaire Coll.); Crawford Co. (larvae) (UArk); Hope (LM, UMo). CONNECTICUT: Deep River (AMNH); Manfield (AMNH); Old Lynn (AMNH); Putnam (AMNH). FLORIDA: Alachua Co. (FSCA); Archbold Bio. Sta., L. Placid (AMNH); Bonita Springs (AMNH); Gainesville (FSCA); 3 km E. Lamont (UM); Monticello (MCZ); Quincy (AMNH, FSCA); Shalimar (Hilton Coll.); Suwannee Springs (pupa *ex* larva) (ROM); Torreya State Park (AMNH, LACM); White Springs (larva) (AMNH). GEORGIA: Atlanta (AMNH, CM); Cooper Creek State Rec. Area, Fannin Co. (AMNH, LACM, UGA); Emory Univ. (FSCA); Lawrenceville (UM); Macon (UM); Ohoope River (CM); Savannah (UM); Tifton (UGA). ILLINOIS: Chicago (FMNH); Lacon UIl); Osborn (UM); Palos Park (FMNH, UIl); Putnam Co. (UIl). INDIANA: Bristol (FMNH); Hessville (FMNH, UIl, UM); Knox (FMNH); Miller (FMNH); Mitchell (FMNH); Tresmont (FMNH, YPM). KANSAS: Johnson Co. (Heitzman Coll.); Ottawa (AMNH). KENTUCKY: no other data (MCZ); Morehead (CNC); Rio (UM). LOUISIANA: Baton Rouge (LSU); Denham Springs (LSU); Indian Mound (FMNH); Tallulah (larva) (UMo). MASSACHUSETTS: Barnstable (AMNH); Chatham (MCZ); East Warshaw (AMNH); Edgartown (LM); Lawrence (ROM); Marthas Vineyard (MCZ); Sherborn (MCZ). MICHIGAN: Agric. College (MSU); Allegan (MSU); Augusta (MSU); George Reserve (MSU, MU); Highland Park (UM); Lansing (UM); Lenawee Co. (ROM); Nine Mile Road (UM). MINNESOTA: Minneapolis (YPM). MISSISSIPPI: Aditon (ROM); Bovina (AMNH, BPBM, LACM, Lemaire Coll., Peigler Coll., ROM); Hattiesburg (AMNH, ROM); Jackson (AMNH, ROM); Johnson State Park (LACM); Mississippi State (LACM); Oxford (BPBM, LACM); Pearl (AMNH, ROM); Waynesboro (LACM); Wilmer (LACM). MISSOURI: no other data (CalAcSci); Adair (Heitzman Coll.); Ashland (larva) (UMo); Bagnell (AMNH, LACM); Benton (Heitzman Coll.); Boon (dto.); Camden (dto.); Columbia (also larvae) (UMo); Curryville (UMo); Greene (Heitzman Coll.); Hartsburg (UMo) Jasper (Heitzman Coll.); Jefferson (dt.); Livingston (dto.); Pike (dto.); Putnam (dto.); Randolf (dto.); St. Louis (dto.); Ste. Genevieve (dto.); Stone (dto.); Washington (dto.). NEW JERSEY: no other data (AMNH); Arlington (AMNH); Cape May Co. (AMNH); Cedar Run (AMNH); East Marion (CNC); Elizabeth (CM); Green Village (larva) (AMNH); Lakehurst (AMNH); Manahawkin (AMNH); Morris Co. (AMNH); Newark (AMNH, FMNH); Ocean Co. (AMNH); Paterson (AMNH); Plainboro (AMNH); Smithville (AMNH); Stanhope (AMNH); Watchung Mts. (AMNH); Wodersey (AMNH). NEW YORK: no other data (AMNH, LM); Bedford (AMNH, FSCA); Bronx (AMNH); Brooklyn (CNC); Buffalo (CM); Grand Island (CM); Leviston (AMNH); Long Island (AMNH, CNC); New York (AMNH); Northport (AMNH); West Farms (AMNH). NORTH CAROLINA: Bryson City



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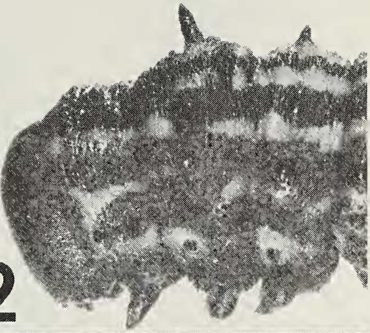

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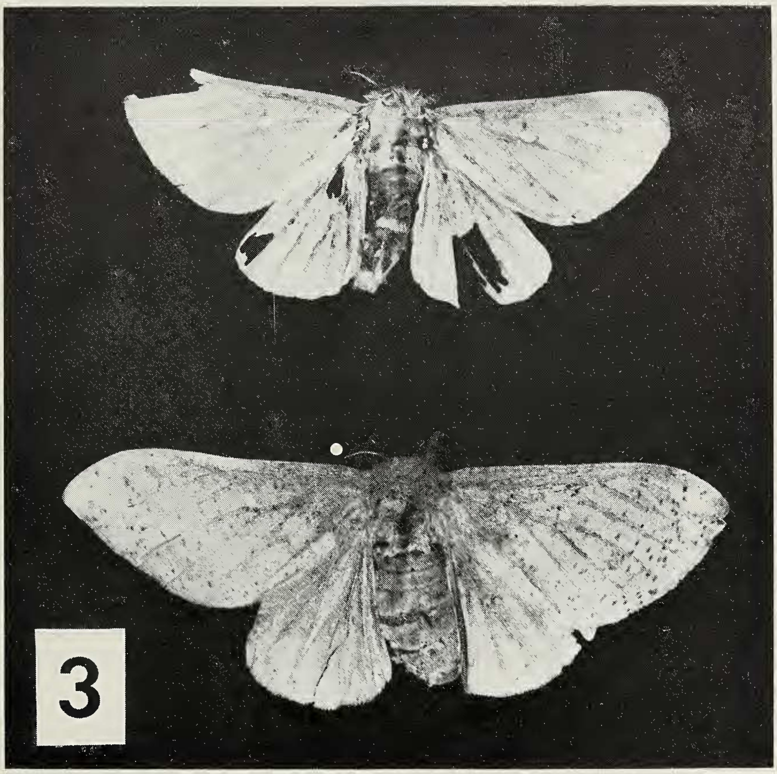

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PLATE VI. 1. Anterior end of larva of *A. senatoria* showing mesothoracic scoli typical for the genus. 2. *A. finlaysoni* which has these horns greatly reduced. Both original photos by L. R. Finlayson. 3. Cotypes of "*Bombyx stigma* Fabricius" in Hunter Collection at Univ. of Glasgow, Scotland.

(UM); Cedar Mt. (UCal); Crestmont (UM); Fontana (CM, LACM); L. Toxaway (AmNH); Maxton (AMNH); Mt. Mitchell (Peigler Coll.); Raleigh (USPM, larva LSU0; Southern Pines (LM). OHIO: Columbs (UM). PENNSYLVANIA: Butler (CM); Delaware Water Gap (AMNH); Mt. Airy (AMNH); Pittsburgh (CM); Sharpsburg (CM); Shawville (CM); Slippery Rock (CM). RHODE ISLAND: Deardon (MCZ); Elmwood (CM); North Scituate (AMNH); Rockland (AMNH). SOUTH CAROLINA: Clemson (AMNH, BPBM, CLU, LACM, Lemaire Coll., Peigler Coll., ROM); Columbia (LACM); Coosawhatchie (AMNH); Florence (CLU); Galivants Ferry (AMNH); Myrtle Beach, Arrowhead L. (CNC); Six Mile (AMNH, LACM); Sleepy Creek (CM). TENNESSEE: Allardt (UM); Burrville (CNC); Gatlinburg (FMNH); Knoxville (CNC); Monteagle (AMNH, CNC, FMNH); Sunbright, Morgan Co. (FMNH). VIRGINIA: Falls Church, Fairfax Co. (UM); Nelson Co. (CM). WISCONSIN: Chippewa Falls (AMNH). Examined 161+ males, 118+ females, dissected 19 males and 16 females.

ARTIFICIAL HYBRIDIZATION

A few crosses have been made within the genus, all within the last few years. Females of any species will apparently attract males of any species providing they emit pheromone at the right times of day and year for the particular males in the area.

A. peigleri ♂ X *A. consularis* ♀

Using a female of *A. consularis* reared from a larva taken in Statesboro, Georgia, males of *A. peigleri* were attracted in Greenville, South Carolina. The percent hatch was extremely high. Mature larvae (pl. I, fig. 9) were strikingly intermediate, having reddish heads, black bodies, and yellow-orange stripes. Adults were intermediate, tending more toward *A. consularis*. A pair is figured on pl. II, figs. 9-10. Specimens are in AMNH, LACM and ROM.

A. senatoria ♂ X *A. oslari* ♀

Using Arizona stock of *A. oslari*, a male of *A. senatoria* was attracted at 2:15 PM (EDT) in Pomfret, Connecticut by Benjamin D. Williams III. He succeeded in rearing several to adults. The larvae were not unlike those of the above cross with light heads and dark bodies, and the adults showed a nice blend of characters. After overwintering, the females emerged in May and the males in June and July.

A. pellucida ♂ X *A. virginiensis* ♀

Using adults from caged pupae this cross was made in Toronto by the senior author with a male from McClellanville, South Carolina and a female from Chaffeys Locks, Ontario. Larvae and adults were intermediate, even in genital characters. The series is in the ROM.

A. virginiensis ♂ X *A. discolor* ♀

Adults emerged from caged pupae, the father being from Pine Grove, Pennsylvania and the mother from Hamilton, Texas. Larvae looked more like the father species and one larva had distinct light green in place of the dark gray stripes. Some diapaused and others did not. A large series of adults was obtained and these resembled *A. virginiensis* mostly and exhibited very little variation among themselves. Most of the series is in AMNH with pairs in other collections. A pair is figured on pl. II, figs. 11-12.

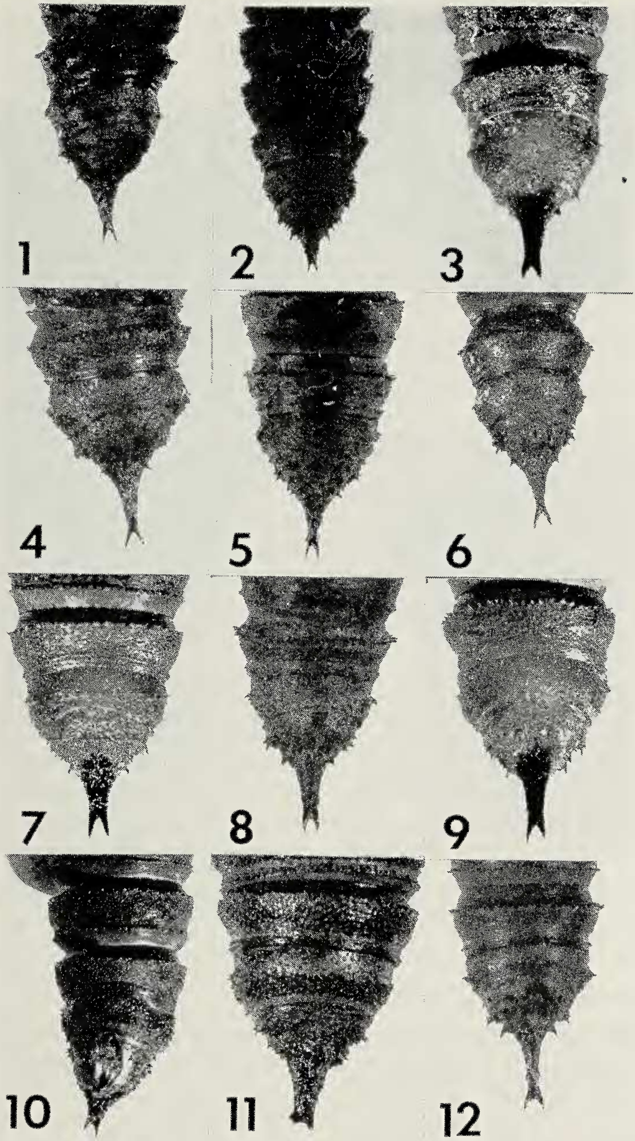

PLATE VII. Photographs of pupae showing cremasters. 1. *A. stigma*. 2. *A. consularis*. 3. *A. manitobensis*. 4. *A. senatoria*. 5. *A. peigleri*. 6. *A. finlaysoni*. 7. *A. pellucida*. 8. *A. virginiensis*. 9. *A. pellucida*. 10. *A. assimilis*. 11. *A. dissimilis*. 12. *D. rubicunda*.

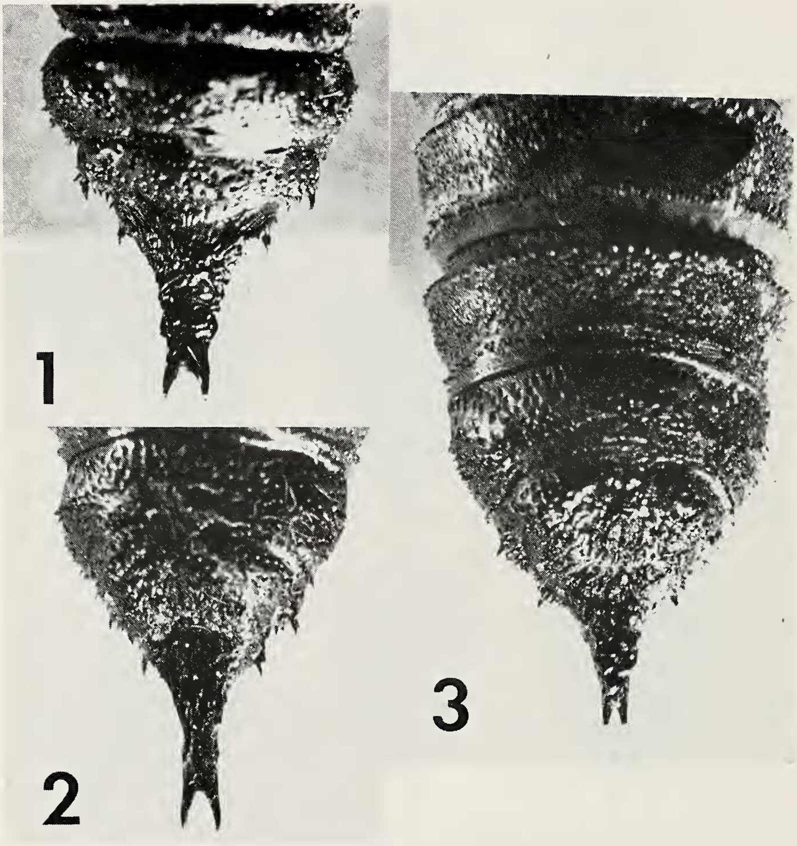

PLATE VIII. Photographs of pupae showing cremasters. 1. *A. fuscosa*. 2. *A. discolor*. 3. *A. oslari*.

A. virginiensis ♂ X *A. discolor* ♀ F_2

A brother-sister pairing of the above hybrids resulted in ova which gave very little hatch. Larvae were weak and only three reached the final instar but none pupated. Possibly a disease killed these larvae.

A. pellucida ♂ X (*A. virginiensis* ♂ X *A. discolor* ♀) ♀

A hybrid female attracted a male of *A. pellucida* in Greenville, South Carolina at 12:28 PM (EDT) and she laid a full complement of ova. All larvae died when very small which suggests hybrid inviability.

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